THE CANADIAN BIRD BANDER'S TRAINING MANUAL

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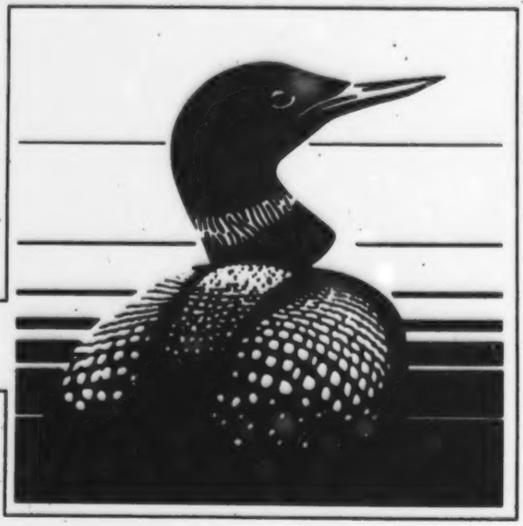

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SUMMARY

The Canadian Bird Bander's Training Manual and the companion, *The Instructor's Guide* have been designed to complement each other. Both are the result of the collective work of many experienced banders and trainers from Long Point Bird Observatory*. The motivating factors in the production of these manuals have been to ensure the safety and welfare of the birds involved in any banding project, as well as to ensure that banders gather accurate and complete data.

All banders and prospective banders should familiarize themselves with the information presented in *The Canadian Bander's Training Manual* especially the sections related to the Bander's Code of Ethics, the history of banding, how to design a banding project, the banding permitting policy and procedures in Canada, and how to maintain good banding records. Landbirds are emphasized throughout this training manual for two main reasons: these species are relatively delicate and may be at greater risk in a banding operation; in addition, the most commonly used technique to capture landbirds is mist netting which requires more training than other capture techniques. You will also find in this manual related chapters covering other techniques for capturing and handling birds, the extraction methods, how to correctly age, sex and band landbirds, what to do to prevent bird injuries and fatalities as well as how to treat injuries.

Information related to these training manuals, including the list of species being banded under the North American scheme, the band sizes recommended for each species and all the codes to be used for data submission are found in *The North American Bird Banding , Volume 1* (Canadian Wildlife Service, 1991). Information on ageing and sexing techniques is found in *The North American Bird Banding Techniques, Volume 2* (Canadian Wildlife Service and U.S. Fish and Wildlife Service, 1977), still distributed to all banders by the Bird Banding Office, but the new Pyle publication (Pyle, P. *Identification Guide to North American Birds, Part 1: Columbidae to Ploceidae*, Slate Creek Press, California, 1997) is now the Bird Banding Office approved reference for ageing and sexing techniques for all Passerines and near Passserines species. Please note that all information about the submission of banding schedules has changed and trainees should be encouraged to use Band Manager, the new data entry and management program. The Bird Banding Office ** can provide further information about this computer program.

The Canadian Bird Bander's Training Manual and *The Instructor Guide* were first completed in December 1994. Draft versions of both manuals have been previously distributed throughout North America for use. The current publication includes only minor changes to the original Bander's Training Manual (e.g. some information was added in the section 9 dealing with: Causes of death and Treatment of injured birds; as well as an Appendix F to help understand better moults in passerines species). Since 1994, other training materials have been initiated for different groups of species (e.g. passerines, raptors, hummingbirds, waterfowl) by the North American Banding Council. Consult the Bird Banding Office for more information. Some other training manuals may already be available for your use.

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RÉSUMÉ

Le *Manuel canadien de formation pour le baguage des oiseaux* et le *Guide de l'instructeur* sont complémentaires et nous recommandons aux responsables de formation de les utiliser ensemble. Ces manuels sont le résultat d'efforts collectifs de plusieurs bagueurs d'expérience et de bagueurs instructeurs à Long Point Bird Observatory *. Les facteurs qui ont motivé la préparation des ces manuels sont avant tout la santé et le bien-être des oiseaux capturés pour des projets de baguage, mais aussi pour s'assurer que les bagueurs ont des données de baguage exactes et complètes.

Nous encourageons tous les bagueurs actifs et bagueurs en formation à lire toute l'information contenue dans le *Manuel canadien de formation pour le baguage des oiseaux*, tout spécialement les sections qui ont trait au Code d'éthique du bagueur, l'historique du baguage des oiseaux, et comment bien préparer un projet de baguage. On retrouve aussi dans ce manuel les politiques et règlements quant à l'obtention d'un permis de baguage des oiseaux au Canada et comment bien gérer les données de baguage. Une grande partie de ce manuel traite du baguage des espèces passereaux et ceci pour les raisons suivantes: ces espèces sont particulièrement délicates à manipuler et à baguer; de plus, l'utlisation de filets japonais, la technique la plus utilisée pour capturer les passereaux, demande beaucoup de pratique. Mais vous trouverez aussi dans ce manuel de l'information sommaires sur d'autres techniques de capture et d'extraction des oiseaux, comment âger et sexer correctement les oiseaux, et comment éviter les blessures et les accidents mortels aux oiseaux, et finalement comment traiter les oiseaux blessés.

D'autres informations complémentaires à ces manuels de formation, incluant la liste complète des espèces baguées en Amérique du Nord, les grandeurs de bagues recommandées pour chacune des espèces, et tous les codes à utiliser dans les rapports de baguage, se retrouvent dans *Le baguage des oiseaux d'Amérique du Nord, Volume 1*(publié par le Service canadien de la faune, 1991). Les informations portant sur les techniques pour âger et sexer les espèces d'oiseaux bagués sont incluses dans *Le baguage des oiseaux d'Amérique du Nord, Volume 2* (publié par le Service canadien de faune et le Fish and Wildlife Service des États-Unis, 1977). Le Volume 2 est encore distribué aux bagueurs par le Bureau de baguage des oiseaux mais le nouveau guide de Pyle (Pyle, P., *Identification Guide to North American Birds, Part 1: Columbidae to Ploceidae,* Slate Creek Press, Californie, 1997) est maintenant la référence acceptée par le Bureau de baguage pour âger et sexer tous les passereaux et autre espèces proches. Veuillez noter aussi que l'information concernant la soumission des rapports de baguage a changé et que les bagueurs en formation devront être informés d'utiliser Band Manager, le nouveau logiciel pour soumettre et gérer les données de baguage. Le Bureau de baguage des oiseaux ** pourra fournir des informations supplémentaires sur ce programme sur demande.

Le Manuel canadien de formation des bagueurs d'oiseaux et le *Guide de l'instructeur* ont été complétés en décembre 1994. Les ébauches de ces deux manuels ont été distribuées depuis lors pour de la formation un peu partout en Amérique du Nord. La présente publication inclut quelques ajouts au manuel original (il y a de l'information supplémentaire à la section 9 où on traite des traitements à donner aux oiseaux blessés ; on a aussi ajouté en appendice F de l'information sur les étapes de mue chez les passereaux) De plus, depuis 1994, grâce à l'initiative du North American Banding Council (NABC), d'autres manuels de formation pour divers groupes d'oiseaux bagués (incluant les passereaux, les oiseaux mouches, les rapaces et la sauvagine) ont été mis en oeuvre. Consultez le Bureau de baguage des oiseaux .

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INTRODUCTION

Bird banding is both a delicate art and a precise science. It should come as no surprise that it not only requires sensitivity and intelligence, it requires training. This is in the interest of the birds' safety and in the interest of gathering accurate and useful information.

Nearly all beginning banders are nervous and a little awkward. This is a good sign since it signals that you understand that you are holding something very much alive and precious. After a time though, it can be all too easy to become complacent. A good bander is always on guard against complacency and realizes that, above all, banding is a great privilege.

The Canadian Bander's Study Guide and *The Instructor's Guide to Training Bird Banders in Canada* are designed to complement each other. All banders and prospective banders should familiarize themselves with the information presented in the Study Guide. The Instructor's Guide, however, is generally available only to trainers. The video — *Banding Together* — will be of interest to all banders, but will be especially useful to beginners. There is no question that "a picture is worth a thousand words" and we hope that the video will successfully depict some of the finer intricacies of bird banding. Still, a video is certainly no substitute for hands-on teaching.

The motivating factor in the production of these guides is the safety and welfare of the birds involved. Indeed, this principal takes precedence over all other considerations in any kind of banding operation.

Landbirds are emphasized throughout these guides, with particular emphasis on mist netting. This is because 1) landbirds are relatively delicate and thus at greatest risk in a banding operation, 2) mist netting is the capture technique most widely used for landbirds, and 3) mist netting requires more training and skill than other capture techniques. To learn more about special topics (e.g. capturing and banding raptors, sexing waterfowl, using nest traps), consult the Banding Office, the Bird Banding Manual, or professionals working in the field you are interested in.

You may want to band birds only as a small part of a short-term research project, perhaps focusing on a single species. Or you may plan to use banding as a major part of your future plans. In either case, responsibilities are the same and you need the same basic training. Some people will need only limited training. For example, if you're banding only geese, it probably doesn't really matter whether you can tell a robin from a Blue Jay. Your trainer can recommend that a banding permit be limited to a certain species or trap type, or issued for use on a specific project only.

Training must be from a qualified trainer. Institutional trainers are listed in Appendix A; the Banding Office will be able to give prospective trainees a more complete listing of trainers in specific geographic regions in Canada.

The amount of training required very much depends on the nature of your project, the type of permit you want to acquire, the speed at which you learn, accessibility to a good trainer, and the availability of training opportunities. It is impossible to establish quantitative guidelines regarding how much time is required or how many birds need to be handled. If you need a permit in a hurry, basic training is still a requirement, and you should plan for this. This is particularly relevant to graduate students.

We lead the Bander's Study Guide off with the most important section — A Bander's Code of Ethics. Read this section slowly, think about it, assimilate it, and run your banding operation with this Code in mind. We then take you through a summary of background material having to do with the history of banding, project design and administration before focusing on practical and technical topics.

It is up to the trainer to assess a trainee's knowledge and practical skills, following completion of a step-wise training program. The trainer grades trainees according to the specifics of the banding project that they will be involved in. Some trainees will have very specific research projects (e.g. graduate students studying a single species), while others will have much broader interests (e.g. personnel at bird observatories). Your permit should reflect the specifics of your research and it is up to you to ensure that your trainer is aware of any special needs you might have.

Along with a training manual, trainers are supplied with a "Bander's Report Card" to guide the assessment process. A copy of this report card is provided as Appendix E in this manual, to give an overall feel for the content and structure of a thorough training program.

There is a lot of information presented in this guide. It is essential that trainees read it over at least once prior to their training to orient themselves and preview what will be learned. After a week or two of training, it should be reviewed in its entirety. Things will make a lot more sense then.

What makes for a good trainee? A good trainee is never afraid to ask questions or to insist on adequate training time. Watch first, then do under supervision. Learn each new step openly right in front of your trainer, so that he/she can see exactly what your are doing. Once you are permitted to do certain things alone, have your trainer spot-check you to see that you aren't developing bad habits and to ensure that your age and sex determinations and measurements are reliable. "Brush-up" sessions with your trainer after a few weeks or months on your own can be very helpful. Don't get arrogant or over-confident; a good bander has a life-long attitude that there is more to learn, and recognizes that everyone, even the most experienced, can make a mistake now and then. Keep your humility. At the same time, confident handling is important to bird safety and that's what we want you to learn.

This guide is largely a compendium of material taken from other sources. Some parts summarize important details presented in *North American Bird Banding: Volume 1* (Canadian Wildlife Service 1991) and *North American Bird Banding Techniques: Volume 2* (Canadian Wildlife

Service and U.S. Fish and Wildlife Service 1977). These manuals will hereafter be referred to simply as the "Bird Banding Manual". This guide is not intended to supplant the Bird Banding Manuals; they too are still required reading.

Technical sections of this guide profited enormously from *The Ringer's Manual* (Spencer 1992), *The Australian Bird Bander's Manual* (Lowe 1989), *A Manual for Monitoring Bird Migration* (McCracken *et al.* 1993), *A Syllabus of Training Methods and Resources for Monitoring Landbirds* (Ralph *et al.* 1993), and an *Identification Guide to North American Passerines* (Pyle *et al.* 1987). These references (and others listed in the Bibliography) should be read to gain further insight.

1. THE BANDER'S CODE OF ETHICS

Bird banding is used around the world as a major research tool. When used properly and skilfully, it is both safe and effective. The safety of banding depends on the use of proper equipment, and on the expertise, alertness and thoughtfulness of the bander.

The Bander's Code of Ethics applies to every aspect of banding. The most essential responsibility a bander has is to the bird. Other things matter a lot, but nothing matters so much as the health and welfare of the birds you are studying. Every bander must strive to minimize stress placed upon birds and be prepared to accept advice or innovation which may help achieve this goal.

Methods should be examined to ensure that the handling time and types of data to be collected are not prejudicial to the bird's welfare. Be prepared to streamline the procedures of the banding operation, either in response to adverse weather conditions or to reduce a backlog of unprocessed birds. If necessary, birds should be released unbanded or the trapping devices should be temporarily closed. Banders should not consider that some mortality is inevitable or acceptable in banding. Every injury or mortality should result in an assessment of your operation. Action then needs to be taken to minimize the chances of repetition. A short list of cautionary notes is presented in the box below; more details are found in Section 9.

It is the responsibility of banders to ensure that their work is beyond reproach and to assist fellow banders in maintaining the same high standards. Every bander has an obligation to upgrade standards by advising the Banding Office of any difficulties encountered and to report innovations.

Banders have other responsibilities too. They must submit their banding data to the Banding Office promptly, reply promptly to requests for information, and maintain an accurate inventory of their band stocks. Banders also have an educational and scientific responsibility, to make sure that banding operations are explained carefully and are justified. Finally, banders have a duty to ensure that if they are banding on private property, that the wishes of the landowner are respected and that permission is obtained.

The Bander's Code of Ethics

1. *More than anything else, banders are responsible for the safety and welfare of the birds they study.* This means that stress and risks of injury or death need to be minimized. Some basic rules are as follows:

   - handle each bird carefully, gently, quietly, and with respect
   - capture and process only as many birds as you can safely handle
   - close traps or nets when there are known predators in the area
   - do not band in inclement weather
   - frequently assess the condition of traps and nets and repair them quickly
   - trainees must be properly trained and supervised
   - check nets every 20 to 30 minutes
   - check traps as often as is recommended for each trap type
   - properly close all traps and nets at the end of the banding day
   - do not leave traps or nets set and untended
   - only double-bag non-aggressive birds of the same size and species
   - use the correct band size and banding pliers for each bird
   - treat all bird injuries in the most humane way

2. *Banders must continually assess their own work to ensure that it is beyond reproach.*

   - reassess methods and your approach whenever an injury or mortality occurs
   - accept constructive criticism from other banders

3. *Banders must offer honest and constructive assessment of others' work to help maintain the highest standards possible.*

   - publish innovations in banding, capture and handling techniques
   - educate prospective banders and trainers
   - provide feedback of any instances of mistreatment of birds to the bander
   - if there is no improvement, then file a report with the Banding Office

4. *Banders must ensure that the data gathered are accurate and complete.*

5. *Banders must obtain permission to band on private property.*

2. THE HISTORY OF BANDING

The first recorded instance of bird marking dates back to about 200 B.C. when marked birds were used as messengers by the military and sportsmen. Until the inception of systematic, scientific bird banding in Denmark in 1899, all attempts to mark birds were individualistic, involving the use of non-standard markers such as coloured string, paint, metal shields around the neck or tarsus, and toe clipping.

Ernest Thompson Seton and John James Audubon are acknowledged as the first "banders" in Canada and the U.S., respectively, even though they did not use bands. Audubon tied silver threads around the legs of nestling Eastern Phoebes in Pennsylvania in 1803 and was lucky enough to have the first returns in North America when he caught two of his nestlings again the next spring. In Canada, Seton marked several Snow Buntings with printer's ink in 1882 in Manitoba.

Key to the development of a continent-wide banding and recovery program was the formation and acceptance of a single concept; namely, that with the cooperation of North American ornithologists, the capture, marking and subsequent encounters of individual birds would lead to invaluable data on species' habits, migration routes and population status. Leon Cole was the first to publicly and formally introduce scientific bird banding to North America at a Michigan Academy of Science meeting in 1901, but it was P.A. Taverner who initiated the centralized distribution of standardized, aluminum bands. In 1904, Taverner placed a note in the *Auk*, offering bands to ornithologists wishing to cooperate in a banding project. James H. Fleming of Toronto, Ontario was the first to use these bands in 1905.

In 1909, the American Bird Banding Association (ABBA) was formed. As a central organization whose role was to oversee the issue of standardized bands as well as the collection and storage of the resulting banding data, the ABBA greatly contributed to the efficiency of the banding scheme. In 1911, the Linnaean Society of New York offered to administer the banding scheme for the ABBA, helping to cover the rising administrative costs of the scheme.

With the signing of the Migratory Birds Convention Act in 1916 came increased cooperation between Canada and the U.S. and the recognition that migratory birds were of international concern. The development of the banding scheme continued until the Bureau of Biological Survey of the U.S. Department of Agriculture took over in 1920. In 1922, Canada's Dominion Parks Branch became officially involved, and by 1923 the Canadian government was responsible for the administration of banding efforts in Canada. Bands were standardized throughout North America and each country became responsible for its own banding data. Now, the U.S. National Biological Survey and Canadian Wildlife Service are jointly responsible for administration of the North American banding scheme.

3. WHY BAND BIRDS?

The work of the bird banding offices in Canada and the U.S. is closely coordinated. Each office acts as a centre for the administration of banding within its own country — reviewing proposed banding projects and issuing bands, auxiliary markers and banding permits to qualified banders. All banding and recovery data are computerized and freely exchanged between offices. Each country encourages the use of the database by banders and researchers. In so doing, the offices promote the publication of significant findings resulting from bird banding. However, banding birds is not a conservation/research program in itself. The Canadian Wildlife Service does not have a conservation program called "bird banding," nor does the government have researchers looking at data collected from banding. Hence, banders are not making a *bona fide* contribution to research if they are banding birds only for the purpose of contributing to the North American database on banding and recovery. We strongly encourage all banders to think hard about the usefulness of the information being gathered.

It is the responsibility of banders to ensure that study design, collection and analysis of data are sound, and that the results are published. The Banding Office reviews all applications for permits. If an application is turned down because of lack of scientific merit, then this decision should be respected.

Bird banding has played a critical role in unravelling many ornithological mysteries. Banding and recovery data provide insight into details of bird migration, population demography, ecology, behaviour and life history. These studies lay the foundation necessary to establish conservation and management strategies for various species.

(i) Banding helps to determine migration flight paths, significant stopover sites, breeding ranges, and wintering ranges of birds.

(ii) Some studies focus on how species behave while on migration, and attempt to discern the physiology, energetics and navigational systems behind migration.

(iii) Banding is used to estimate population size and population turn-over (migration banding, mark-recapture studies). It is also used in studies of demography (number of young per pair, post-fledging mortality, survivorship to next year), providing insight into how populations are maintained.

(iv) Banding plays a role in studies of behaviour on breeding and wintering territories, site fidelity, mate selection, dispersal distances, daily movement patterns, song types and learning, predator defense, resource partitioning, and diet — and how all of these vary according to age, sex and experience. Banding is crucial as a way of identifying and following the fates of individuals throughout a study.

(v) In order to carry out the studies mentioned above, it is often necessary to know the age and sex of individual birds. Many people band known age or sex birds to study the visible physiological changes in plumage, moults and soft parts of a particular species.

In the future, technological development of marking and tracking techniques may replace the use of bands. Miniaturization of radio transmitters and satellite tracking ability are already helping in the study of migration, while DNA "fingerprinting" and isotope "signatures" will be used in the next era of bird study. Even then, birds will still have to be safely caught and handled for these sophisticated techniques to be performed.

3.1. Designing a Research Project

There are two ways that banders can conduct research. You can analyze your own data in the context of a project's design, or you can collaborate with others who have already designed projects (many of which are usually in need of skilled assistance). Many scientific studies could never be undertaken on an adequate scale by individual banders; they are possible only as collective endeavours. Hence, even if you do not have a specific project yourself, you can still contribute meaningful information to a larger, organized project. Contact the Banding Office, universities, and bird observatories, or respond to bulletins in journals for information on how you can help.

Two cooperative projects now being undertaken in North America are Operation Wing Chord and the Monitoring Avian Productivity and Survivorship (MAPS) program. In Operation Wing Chord, banding during the breeding season enables you to submit wing measurement data on a selection of species for individuals of known sex. The plan is to generate enough data to test for sexual differences in wing measurement and to work out keys for those species that are difficult to sex by plumage. The MAPS project is designed to use banding data to assess bird populations across the breeding grounds in North America, with particular emphasis on reproductive rates and survivorship.

If you wish to set up your own research project and analyze your own data, you don't need to be a rocket scientist. But you will need to understand basic statistics (e.g. the mean, probability theory). Among other things, statistics can be used to determine average dates of arrival, significantly early or late occurrences of a species, as well as the proportion of hatch-year birds to adults in a given population. Zar (1984) and Sokal and Rohlf (1981) are both good statistical textbooks, but they are not written for the lay-person. The British Trust for Ornithology (BTO) has produced an excellent introductory guide to ornithological statistics (Fowler and Cohen; undated); see Appendix B for the BTO address.

A good reference on designing simple (do-able) studies is Grubb (1986). Other good references can be found in journals like *North American Bird Bander, Journal of Field Ornithology,* and *Ringing and Migration.* An example of a well-designed research study is outlined in Appendix C.

Project design proceeds through a series of logical steps:

i) Ask a question. All well-designed projects focus on a well-defined question. Depending on the question, this step usually implies some familiarity with others' work on the subject. Recently published literature can be consulted at a university library.

ii) Develop a hypothesis. A hypothesis combines the question with your expectation of what the answer might be, and why. Much of the necessary theoretical background for forming a hypothesis comes from studying the results of others.

iii) Propose and design a project. Most people need help at this stage. In order to design a workable project, you need to determine what kinds of and how much data need to be collected. This is where statistics can help. Usually, the statistical test that will be used to analyze the data dictates, to some extent, the types and sample sizes of data required for analysis. At this stage, banders should have a clearly formulated question, with an hypothesis, a plan for collecting the necessary data and a plan for the statistical analysis of the data. An experienced researcher or statistician can confirm that the proposed sample size and types of data are sufficient for meaningful analysis of the hypothesis. Banders who are experienced with the capture of the proposed species can confirm that the target number and trapping method are easily attainable over the duration of the study. Get others' opinions on the possible limitations of your study; it will save a lot of hardship later on.

iv) Collect the data. This step should be relatively problem free, providing that you have planned how the data are to be collected, and have received the necessary practical training.

v) Analyze the data. The use of a computer with data entry and statistical analysis programs will make analysis that much easier.

vi) Publish your results. Remember that "negative" results are just as important as "positive" results because they allow you and others to build upon them. There is a range of publication outlets available, from regional bird bulletins to international research journals.

vii) Questions beget more questions!

4. PERMIT ISSUE

Because bird welfare is a primary concern, banding permits are issued only to people who have received proper training and whose projects are designed to contribute to the knowledge, conservation and management of North American bird populations. Permit authorizations can be very specific. For example, you may be specifically authorized to band young Herring Gulls only and that these birds must be captured by hand. Or you could apply for a more general permit that would allow you to run a general banding station, with special authorization to use mist nets and to band a wide variety of species. Basically, banders can only conduct those activities that appear on their banding permit. Before applying for a permit, banders should be confident of their qualifications and plan their projects to know which authorizations are needed. Consideration should be given to the capture method, species under study and the types of data needed.

4.1. Types of Banding Permits

Two types of banding permits are available: the Master Permit and the Subpermit. The differences between the two relate to the experience and qualifications of the bander and the responsibilities to be assumed. Because it costs money to process banding and recovery data, banding teams or organizations are required to designate one responsible person to report all banding data.

Master Permits are issued to "responsible individuals" banding on their own or designated from a team of banders who are working together on a project. Master permittees are responsible for coordinating the activities of all Subpermittees within the project, recommending new Subpermittees, reporting encounters and preparing banding "schedules" (see Section 11.4).

Organizational Master Permit projects (e.g. at universities and bird observatories) are overseen by a designated individual who is granted Subpermit "A" within the organization's Master Permit. In this case, the organization's address is used on all correspondence with the Banding Office so that data can be filed in a consistent manner despite possible personnel changes within the organization.

Subpermits are issued to banders working alongside a Master Permittee. Data from all Subpermittee banding are filed in the Banding Office under the Master Permit's number.

4.2. Standards for Permit Issue

(i) All prospective banders must be trained by an authorized trainer before receiving a permit.

(ii) All applicants must be at least 18 years old and must provide recommendations from two active banders (one of whom must be the trainer) vouching for the applicant's ornithological, banding and record-keeping abilities. If a bander is applying for a Subpermit, one of the referees must be the Master Permit holder. A minimum of one year of extensive field experience with a number of species and traps is usually recommended before banders apply for a Master Permit. Depending on the nature of the project (e.g. whether it is single-species or multi-species oriented), Subpermits often require a month or more of training and field experience.

(iii) Applications for a Master Permit must include a project description justifying the need to band birds, details of the species and approximate numbers to be banded, the general location(s) and duration of the project, intended use of the data, a list of the banders working on the project and applications for any required Subpermits.

(iv) If the applicant is sponsored by an organization, the application must be accompanied by a letter from a senior individual in the organization sponsoring the permit requesting that the applicant be designated as the "responsible individual" of the banding project. He/she must be effectively qualified to hold a Master Permit.

(v) All Master Permittees must have access to a personal computer and be able to provide the Banding Office with computerized banding schedules.

Note that banders and trainees do not require a permit if they are under the direct, on-site supervision of a Permit holder. However, if banders will have to work unsupervised for any period of time, they will require a Subpermit.

4.3. Special Authorizations Required in Canada

Banders must obtain special permission to band in more than one province and to band in a federal or provincial park or bird sanctuary. Banders must also request special authorization to:

(i) band waterfowl
(ii) band raptors and other provincially protected species
(iii) band endangered species
(iv) use mist nets
(v) use cannon nets
(vi) use chemicals (i.e. tranquilizers) to capture migratory birds
(vii) use auxiliary markers (e.g. colour bands, radio transmitters)

A banding permit allows banders to salvage dead birds encountered during their studies. Specimens are useful for further study and they should be salvaged whenever possible (e.g. sent to museums, universities). However, a special permit is required to collect birds, to hold or transport live birds, and to possess specimens, eggs and nests. Without this special permit, you can be charged with an offence.

4.4. How to Apply for a Permit

Qualified persons wishing to handle, band or mark birds in Canada, should ask for an application form from the Banding Office, Ottawa, Ontario K1A 0H8. Master Permittees should supply the names and addresses of all prospective Subpermittees when they ask for Subpermittees' application forms. When a request for a permit is received by the Banding Office, an acknowledgement letter will be issued, along with an application form and a request for any necessary additional information. If the applicant has completed appropriate training, has two favourable recommendations (one from his/her trainer) and has a project plan showing how banding will be used to serve the project's need, a permit will be issued.

4.5. Permit Expiry and Renewal

In general, banding permits are valid for two calendar years and are renewed in response to a questionnaire sent to Master Permittees each December and upon submission of banding data. Auxiliary authorizations are issued for one year only. Projects requesting renewal of auxiliary marking must submit their projects to an Animal Care Committee for annual review. This may be difficult for amateurs to do outside of a sponsoring institution (e.g. university). Contact the Banding Office for more information.

4.6. Responsibilities of Permit Holders

Master Permit holders are responsible for their Subpermittees' qualifications and conduct. Master Permittees order all bands, maintain a band inventory, submit all records to the Banding Office in a timely manner, maintain updated copies of all banding schedules, report recoveries, maintain quality control, and generally handle all paper work associated with the permit. Subpermit holders are under the direction of the Master Permittee, who decides upon individual responsibilities. At the very least, Subpermittees must provide the Master Permittee with copies of all banding schedules and band inventories and keep the Master Permittee advised on any problems that might arise. Subpermittees must also let the Master Permit holder know their band requirements in plenty of time to allow band orders to be placed and filled.

All Master Permit holders are responsible for the bands issued to them until the data resulting from their use are reported, the bands are returned to the Banding Office, or until their transfer to another permittee. All transfers must be authorized by the Banding Office. In case of fire, theft or loss of bands, a copy of all band numbers received should be kept in a couple of different places. Band inventories should be conducted at the end of each banding season.

Banders should always double check that the bands they have received correspond to the bands issued to them, as listed on the Banding Office's Issue Slip. This means checking the numbers on the bands themselves, not just the numbers printed on the band envelopes or boxes. If there is a discrepancy, or if any band numbers are illegible, missing, duplicated or out of order, notify the Banding Office immediately.

4.7. Permit Suspensions and Revocations

Permits may be suspended or revoked if the bander's qualifications or conduct is questioned, investigated and subsequently found to be in breech of that deemed acceptable by the Banding Office. This includes exceeding authorizations specified on banding permits, neglecting to submit banding schedules or the mistreatment of birds.

5. NORTH AMERICAN BANDING AND RECOVERY DATA BASE

Banding and encounter data are gathered and stored for the purpose of facilitating research in North America. Researchers are encouraged to request data for analysis, using a *Request for Data on Bird Banding and/or Recoveries Form*. Generally, this information is provided free of charge for those with legitimate research purposes.

Banding and encounter data are contained in their own files, the Banding Retrieval File and the Encounter Retrieval File, respectively. Data are taken directly from the retrieval files, presented in the formats shown in the Banding Manual, and supplied to you on diskette. The Banding Office will not usually summarize or tabulate data for you. However, occasionally the information may have already been tabulated by other researchers and can be made available upon request. The Banding Office has developed its own programs for data manipulation. You may be able to make use of these programs for data summation.

In order to release banding or encounter data, the Banding Office requires that the need for use of the data is justified. The Office also needs to know whether data are required from the Banding Retrieval File, Encounter Retrieval File or both, the type of encounter data required, species, age and sex required, area and time period involved, and the various status and additional information codes desired (consult the Bird Banding Manual for more detail).

Much time and effort goes into data collection and storage, both on the part of those who contribute data and those who administer the banding scheme in North America. Researchers are therefore asked to use data with care and consideration. **Researchers using banding data must obtain permission from the banders involved before their data can be used for publication.** This permission is seldom difficult to obtain, but it is necessary in order to protect banders' own research interests. Banders have the prior right to the analysis and publication of data resulting from their own banding efforts. To guard against the improper use of data, a Policy of Release is included with each data request.

Data on endangered, threatened or sensitive species may be legitimately withheld by the Banding Office. Other data may also be withheld if they are required by government for management or administrative purposes.

6. BANDING ASSOCIATIONS AND OBSERVATORIES

Through annual meetings and publications, regional banding associations and bird observatories provide a forum for the discussion and development of banding philosophy and theory; project design, methodology and data analysis; capture and handling techniques and so on. Most importantly, these organizations allow banders to exchange ideas and experiences, and define research needs. They are also a route to contacting potential trainers.

A list of relevant addresses is given in Appendix A. At the very least, all banders are strongly encouraged to subscribe to *North American Bird Bander* in order to keep abreast of research involving any number of banding-related topics. This journal also contains advertisements for specialized banding equipment.

7. HANDLING BIRDS

The proper way to handle a bird is the safest way. First and foremost is the bird's safety. Your safety is only of secondary importance. Many birds are capable of inflicting a little pain or discomfort, but only in an extreme case, such as when banding a large raptor, heron or gull, are you in any real danger. Some birds will defecate on you, and some will bite or scratch. Sometimes this hurts, and sometimes it just smells a lot, but it is all part of the banding process. In any case, **never** take any of your frustrations out on the bird. Consider the hand which holds the bird to be separate from your body; learn not to flinch when a grosbeak clamps its jaws down tight on your finger or when a flicker defecates in your face while you are checking its fat condition. Laughter is often the best medicine . . .

Right-handed banders normally hold birds in their left hand, leaving their right hand free to scribe, hold banding pliers and so on. Left-handed banders normally hold birds in their right hand. No matter which hand is chosen, you should still feel comfortable transferring birds from one hand to the other, since transference is part of the banding routine.

Never overlap the wings across the back of the bird; this can cause wing-strain and result in tissue damage. Always be careful that the bird's body is not held too firmly. Excessive pressure placed on the neck or body could result in broken ribs, damaged air sacs or suffocation. Breeding females carrying eggs could suffer internal injuries if the abdomen is pressed. You should always check for any signs of panting or stress (see Section 9). A good handler quickly learns to balance a secure, firm hold with a gentle, non-injurious touch.

If a bird struggles loose from your grip, it is much better to just let it go rather than to grab for it. What you usually get is a handful of tail feathers, and you risk injuring the bird by a sudden grasp. Try to refrain from the instinctive desire to seize the bird.

7.1. The "Bander's Grip"

The "Bander's Grip" (Figure 1) is the best and safest way of holding a small or medium-sized bird. Hold the bird with its neck between the first two knuckles of your forefinger and middle finger. With these two fingers closed gently around the bird's neck, the wings can be contained against the palm of your hand. The remaining fingers and thumb are closed loosely around the bird's body, forming a kind of "cage." This hold leaves the bird's legs free for banding.

By pinching the tarsus at the metatarsal joint securely between your thumb and forefinger (Figure 1), the leg is secure enough for banding that, should the bird struggle, the hold will prevent any injury to the leg. You can safely measure the wing chord or check for fat by simply lifting your thumb away from the bird's body (Figure 1).

The key to the bander's grip is to hold the neck firmly enough that the head cannot slip back through your fingers. Your hand should simply cradle the body and restrain the bird from struggling so that it is not injured or expending energy trying to escape. If the bird struggles a great deal, and you are finished banding, the legs can be folded as if the bird was perched, and placed between its body and your ring finger. This will minimize struggling and allows you to proceed with other measurements.

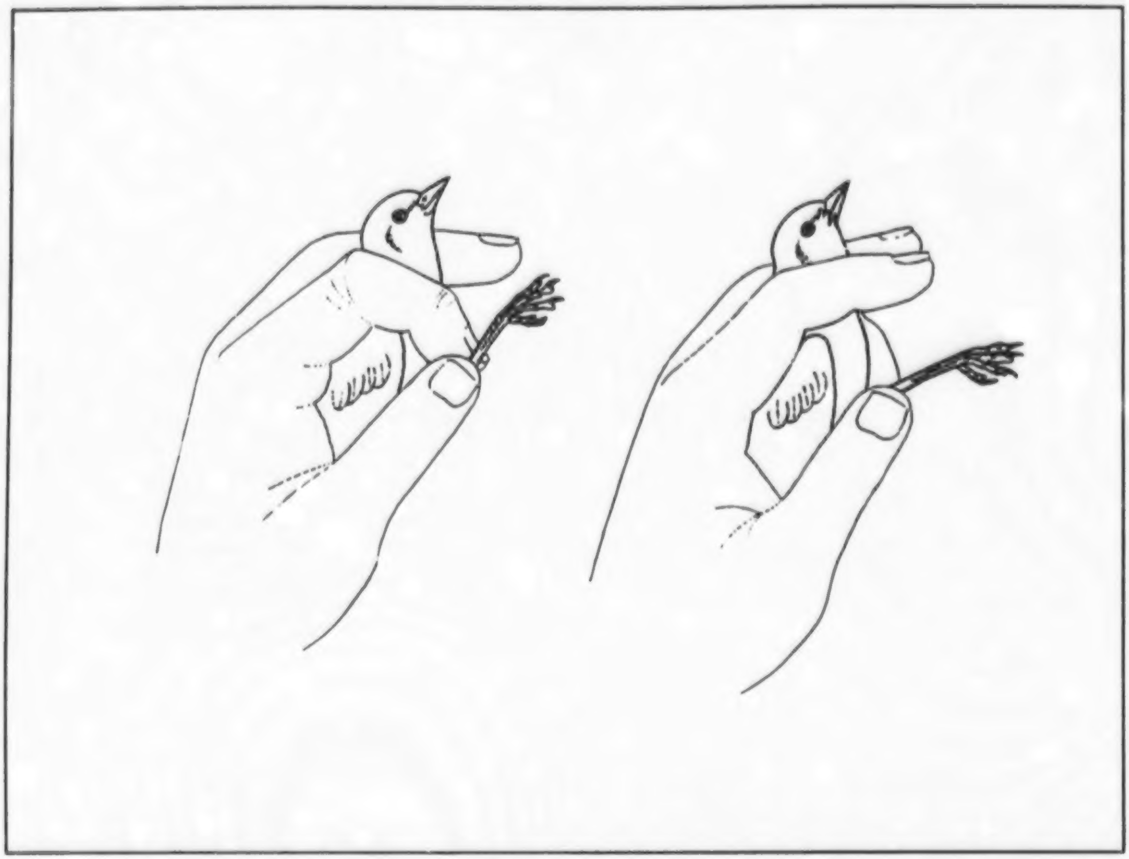


Figure 1. Aspects of the Bander's Grip showing how the tarsal joint can be held (from Lowe 1989).

Although this is the most basic of all banding grips, there are some things you should know about holding certain species:

(i) Most birds are usually docile, but some (e.g. sparrows, starlings, woodpeckers, blackbirds, grosbeaks and jays) will often kick or bite. Some species (e.g. Song Sparrow) lie calmly, then suddenly kick away and free themselves from your hand. Be prepared by keeping a firm grip throughout. Kicking can be minimized by positioning the leg not being banded between your ring finger and the body of the bird as described above. Bad biters can be handed a small twig for them to bite on, or their heads can be covered temporarily by a light piece of cloth. Usually, you're best off just enduring the pain and learning to keep your fingers away from nasty beaks.

(ii) Small birds like wrens are especially able to wriggle out of the Bander's Grip in seconds, just like little bars of soap. They use their feet to put pressure on the fingers around their necks, and quickly slip their heads from your grasp. Again, your grip must be sure, but not stifling.

(iii) Caution is required when handling hummingbirds. They are incredibly fragile and can go into shock due to stress or lack of food. In addition to the Bander's Grip, they can be held for short periods of time by the base of their bill, or better yet, in the "pencil grip" (very lightly holding the wings closed against the body between your thumb and forefinger). Never hold a hummingbird by its legs.

(iv) Care must be taken when handling long-legged shorebirds. Leave their legs free for banding and never fold them up against their body (see Section 9.5.2.).

(v) When holding small raptors in the Bander's Grip, be very certain that your grip is sure and that the talons are under complete control. Raptors will tightly grasp their own feet together and hold their legs in this position for some time. Then they will suddenly lash out, sinking their talons into the object nearest them.

(vi) Some birds (e.g. flickers) are apt to scream a lot. This does not mean they are in pain, but it is certainly disturbing. Forget trying to calm "screamers." The best thing you can do is to process and release them quickly.

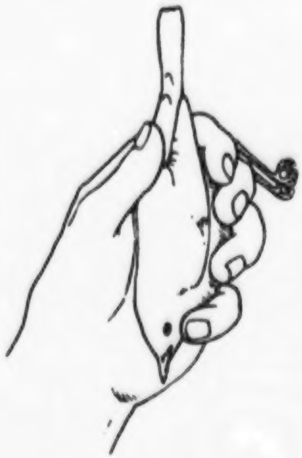


Figure 2. The Reverse Grip (from Svennson 1992).

7.2. The "Reverse Grip"

The "Reverse Grip" is a standard hold in some countries but not widely used in North America. We recommend that you master the standard Bander's Grip before trying the Reverse Grip. In this variation, the bird is held with the tail facing away from you (Figure 2). Your pinky and ring fingers secure the neck against your palm. Your thumb is placed gently but securely across the lower abdomen, below the rib cage. As in the Bander's Grip, the leg can be positioned for banding by pinching the metatarsal joint between your thumb and forefinger.

The Reverse Grip is not efficient if measurements are to be taken, because for this, the bird must then be rotated and held in the Bander's Grip. Processing is faster and there are fewer incidences of escape and injury when you do not have to keep changing your grip. The Reverse Grip is useful, however, for banders with small hands who must handle medium-sized birds (e.g. Common Grackles, Mourning Doves), or when banding swallows and other birds with extremely short tarsi. This grip puts the metatarsal joint close to the thumb and forefinger. The Reverse Grip can also be useful when you're measuring or studying tail feathers.

7.3. The "Photographer's Grip"

Many passerines can be safely held by their legs for brief periods, but you must grasp the legs as close to the body as possible. Never hold hummingbirds, kingfishers or goatsuckers in this grip as their legs are too weak.

The "Photographer's Grip" (Figure 3) is used to hold birds while photographing them since it maximizes the amount of plumage in view, to transfer them from one bander's hand to another, or to examine features. For this hold, you "scissor" grip the bird's legs as high up towards its body as you can, between the fore and middle fingers (or between the ring and middle fingers if your hand is very small) and then pinch the bird's tarsi between your thumb and fore (or middle) finger. In this hold, the bird is securely gripped above and below the metatarsal joint, which is bent into an "L" shape. The bird will be able to flap its wings and rock backwards and forwards, but it should not be able to rock from side to side. Never hold a bird by the ends of its legs alone — they will break! Place your free hand over the bird's back to keep its wings from flapping until the photographer is ready to shoot.

Birds should not be held in this grip for longer than necessary, since they will be expending additional energy trying to escape. Still, it is an essential grip to master since it is often used while extracting birds from mist nets.

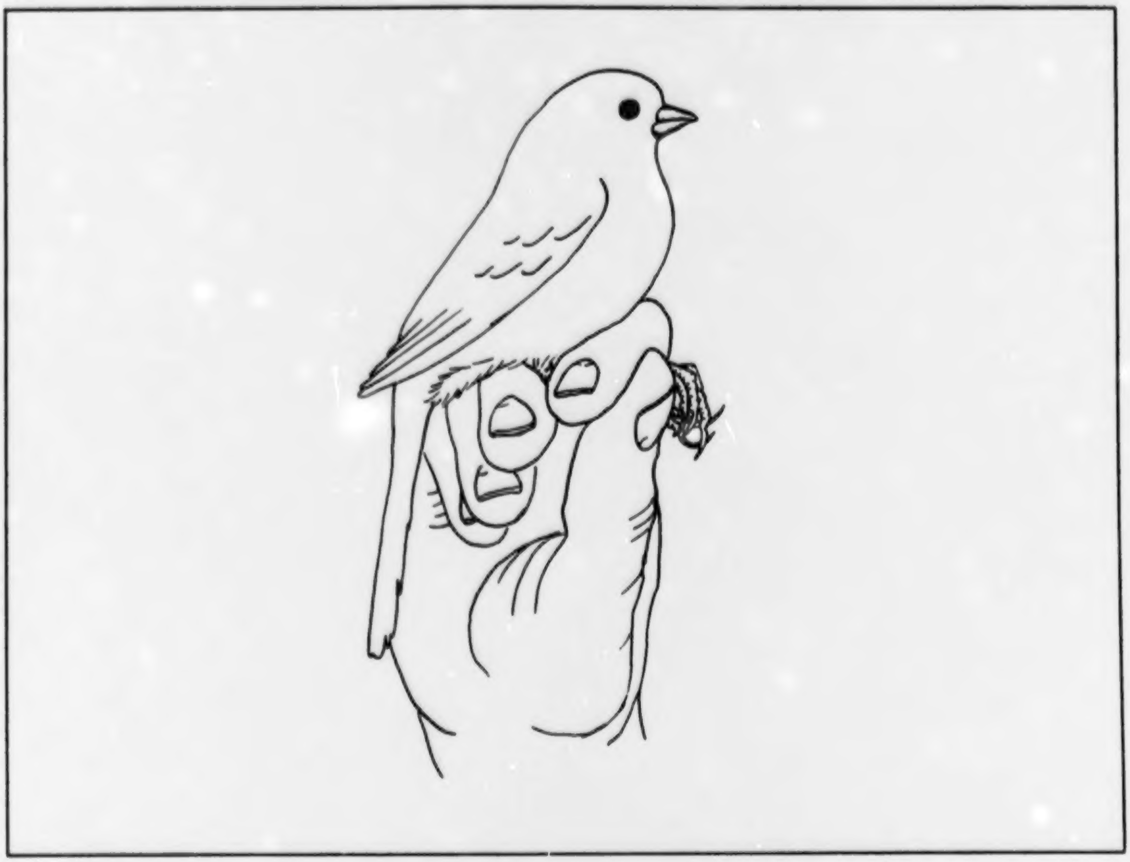


Figure 3. The Photographer's Grip.

7.4. The "Ice-cream Cone Grip"

This grip (Figure 4) is not only helpful for handling ice-cream cones, but also works great on kingfishers, crows, jays and grackles and is particularly useful for many raptors. In this hold, the legs are fully extended down the tail, and the lower part of the bird (the upper part of the legs and tail, the lower part of the wings and body) is clenched in a fist as if you were holding an ice-cream cone. Because the feet are extended away from the hand holding the bird, they are non-threatening. Because the wings are held securely, birds which tend to struggle or flick their wings cannot do so. This decreases the risk of injury to the bird. The ice-cream cone grip (or a reverse form of it) is the preferred way to hold small raptors for banding.

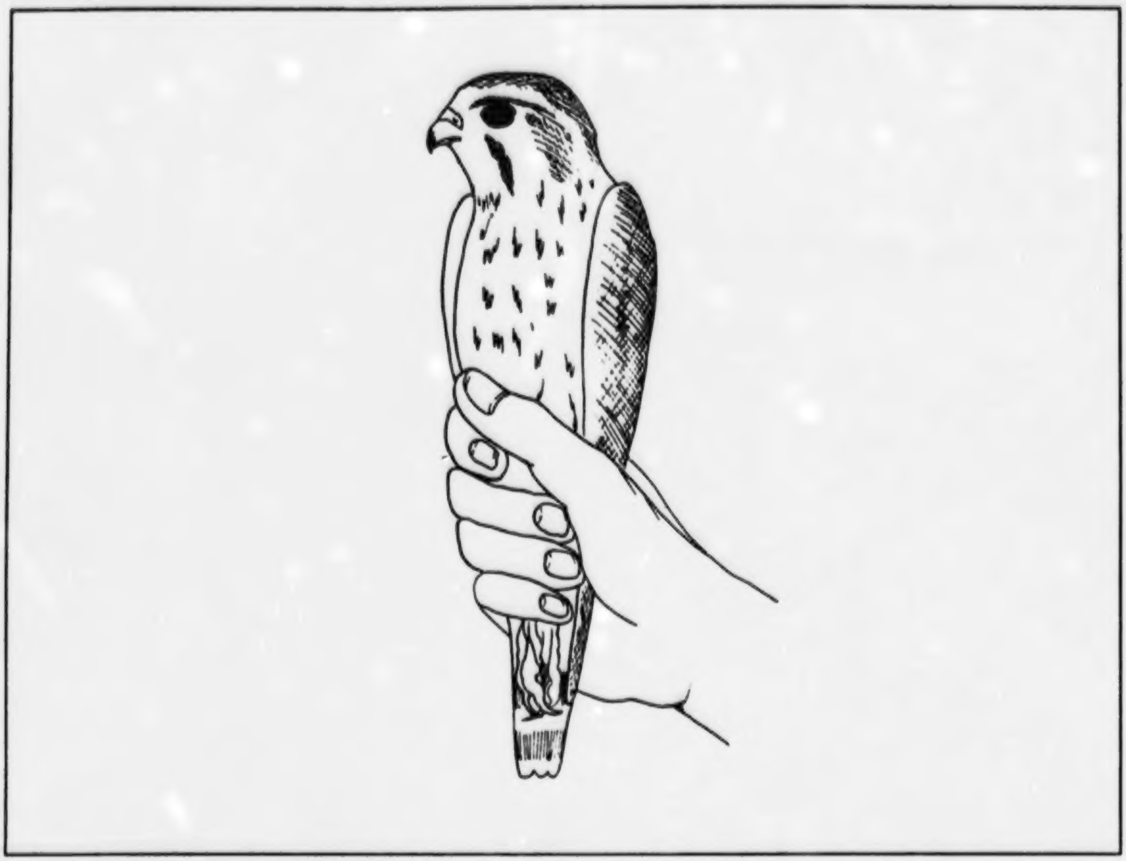


Figure 4. The Ice-cream Cone Grip.

7.5. "Free" Holds

Many waterfowl, raptors, herons and gulls are simply too large to be easily held and banded by the same person. In addition, many large birds have nasty talons and bills. In these cases, handling is often done by one person; banding is done by another.

Larger ducks, swans and geese can be held on their backs either on your lap, between the inner thighs, between two hands or under your arm. The head and neck should always be under control and point away from you so that the legs are free for banding. You will also soon learn to point the cloaca away from you! Most waterfowl are not aggressive, but geese may try to bite and they have sharp claws. These are strong, slippery birds that will escape easily if your hold is not secure. Some old-time waterfowl banders hold waterfowl by their wings, overlapped across the birds' backs. This is **not** a safe grip!

Herons and gulls can be held on the lap or between two hands as described above, but to guard against their sharp bills, a cloth bag can be placed over their heads. The person holding the bird must keep the head and neck under control.

When approaching raptors in a trap or net, come up from behind. Try to distract the bird with one hand until the talons can be safely controlled. Place it in the Ice-cream Cone Grip immediately after extraction. For birds larger than a Red-tailed Hawk, it is advisable to have two banders on hand. If only one bander is available, a large raptor may be held under your arm or on your lap with a cloth bag over its head and your hand clenched firmly around its legs. Needless to say, great care should be taken when handling powerful birds of prey (Cooper's Hawk size and larger).

7.6. Carrying Devices

Banders often catch many birds at once. Since banding near the traps prevents other birds from getting caught, banders usually gather the birds up in bags or boxes and carry them back to a central banding station. This also allows the birds to settle down and permits the bander to carry many birds at once.

This leads to a very important point. Once all of your carrying devices are filled, always release any additional birds that have been captured. Release them immediately at the trap or net site. Remember, you are not out to break any banding records, particularly when bird welfare is at stake. Still, on those odd occasions when you get caught without a carrying device, you can naturally carry the bird in your hand, perhaps under your shirt to minimize stress. We don't much like the idea of carrying birds in shirt pockets. Birds should never be put in your pants pockets for obvious reasons.

7.6.1. Bird Bags

Draw-string bird bags are made of thin, soft cotton (e.g. old sheets and pillow cases) and measure about 20 cm by 15 cm, depending on the size of the bird. It's a good idea to have an assortment of sizes of bags on hand. Draw-strings must be long enough that they can be hung on a carrying device and hitched shut to prevent the bird's escape. The bags must be large enough that you can reach in with your hand to extract the bird in the Bander's Grip. If the whole body and tail of the bird can fit easily in the closed bag, then it is the right size. If a bag is too small for the bird, feathers could break or bend, or the wings could become strained from being held in an awkward position. The seams of the bags must be finished with no loose threads. Otherwise, the bags should be turned inside out to prevent the bird's claws from becoming entangled. Finally, making the bags so that they come in different colours or prints can allow you to quickly recall which bird is in which bag. Avoid making bags out of camouflage-coloured material.

In a pinch, it is permissable to use small brown paper bags, twisted at the top, to carry birds temporarily. However, they are not "breathable" and can't be hung up and so are not at all recommended for regular use. Plastic bags are naturally not to be used.

Never set bagged birds down on the ground (where they can "hop" away or be stepped upon), in the shelf of a mist net (where they could place excessive tension on parts of the net and injure other birds), or hang them on a tree branch (where they can be easily forgotten). Instead, hang bags on the eye cups of your binoculars if they are large enough, fashion a wire hook to wear around your neck, wear a necklace made out of shower hooks, or simply keep bags looped safely around your wrists. Special posts for hanging bags can be installed at convenient spots near traps or nets, but be sure that you don't forget that a bag has been left hanging there.

In some cases, there will be a rush of birds and no number of bags will be enough to carry them all. In this case, place **no more than two birds** of the same species per bag, provided that they will fit **roomily**. There is one very definite exception to this: **always** single-bag large or aggressive birds. Jays, grosbeaks, grackles, chickadees, woodpeckers and raptors should never be double-bagged, whereas warblers, kinglets and non-aggressive sparrows can be double-bagged. Always be sure that the bander is informed of all bags containing more than one bird so that they can be processed first or re-bagged separately as soon as possible.

The final point about bird bags is that you must keep them clean. This means that they should be laundered routinely in hot water. Dirty bags are not only unsightly and unsanitary, they might harbour diseases and parasites and reduce air circulation. Never use wet bags.

7.6.2. Carrying Boxes

Small carrying boxes, usually with two or three compartments, are sometimes used to store birds prior to banding (Figure 5). Several birds can be stored in one compartment, but be sure to follow the same guidelines for double-bagging birds (e.g. don't mix aggressive species, process first, separate to individual bags as soon as possible).

These boxes are typically equipped with a denim sleeve or piece of thick rubber with a star-shaped access hole cut into it. Boxes should be made partly of peg-board for air circulation. The floor should be made of wire mesh so that excrement does not build up, but fine enough mesh so that feet can't poke through.

Larger, multi-compartmentalized holding boxes ("hotels") come in handy back at the banding station when you want to transfer birds to a little more comfortable environment and have run out of empty bird bags. Do not place more than one bird in a compartment. Hotels also allow you to sort the birds by species prior to processing, and even function well as temporary shelters for recovering birds.

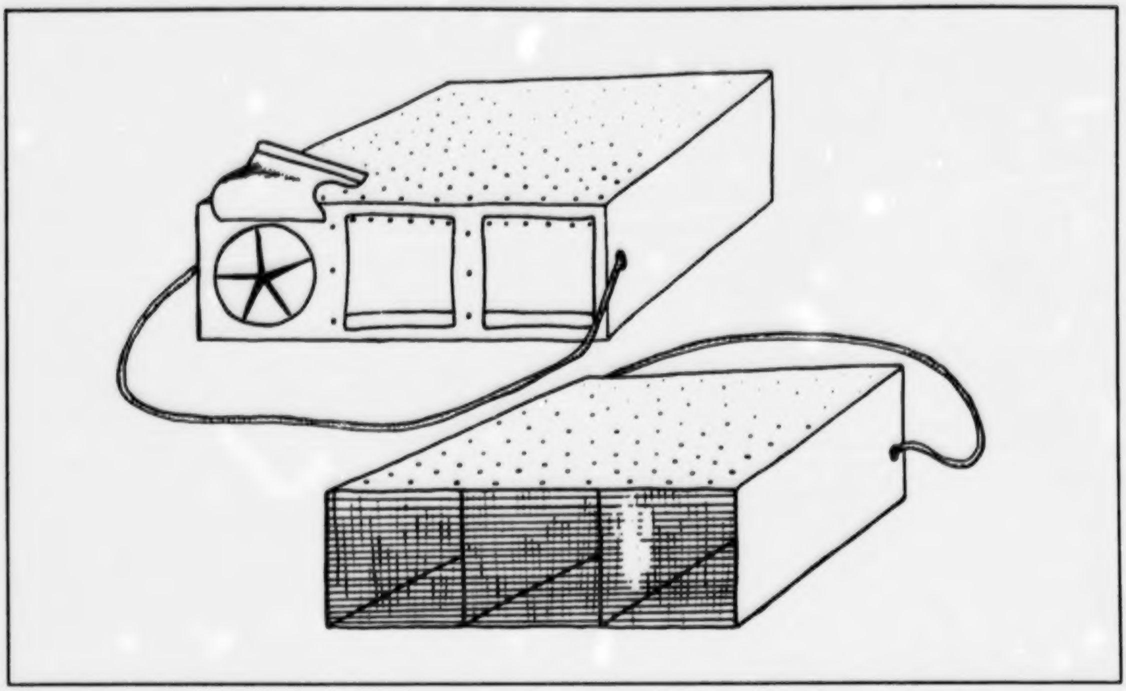


Figure 5. A carrying box (made of wire mesh and peg board) with three compartments (top and bottom views) and a rope carrying handle. Top shows access hole made of rubber with star-shaped cut and weighted flaps that drop over holes. Bottom shows wire mesh construction.

7.7. Releasing Birds

As a general rule, birds should be released unbanded if they have been waiting to be banded for longer than one hour. The time really depends on the temperature and on other conditions. For example, if it is very cold outside, birds should be released as quickly as possible to allow them maximum time to feed. In any case, it is important to keep track of time. The following birds should be banded as soon as possible and **must** be released at their point of capture: adults caught while on a breeding territory, females with a brood patch, and dependant juveniles. Band and release family groups together. To avoid shock in hummingbirds, you should process them immediately upon extraction (or release them immediately at the net site if they are not going to be banded).

For release, waterfowl can be grasped by both hands and thrown upwards, into the wind and towards water. Most shorebirds should be taken near the water's edge and released by lowering them to ground level. When your grip is loosened, the bird should walk away by itself.

Raptors should be held in the Ice-cream Cone Grip. While facing into the wind and away from nearby obstacles (e.g. trees or buildings), the bird may be gently but firmly thrown upwards and away from you. (Any large bird with long wings and short legs may be released this way.) Owls at night should be simply placed in a safe, dark spot; when their eyes readjust to the dark, they'll fly away.

Passerines should never be thrown into the air or released high above the ground since the bird may be unable to fly properly due to cold, stress or wing-strain. When releasing a small bird, it is often best to hold it in the bander's grip, crouch down low, and simply open your hand palm upwards.

Stations banding large numbers of birds often use a release hatch built into the banding lab wall (Figure 6). After banding and weighing, the bird is gently "dunked" into this release hatch, where it lands upon a platform. The release hatch is open to the outside but the entrance back to the banding lab is blocked. Birds usually fly away immediately, but pay attention to each bird after it has been released to make sure it is healthy. You must be able to see or hear each bird as it flies out of the release hatch. That's why the hatch is normally located beneath a window. The flap door to the inside can also be used to check for departure.

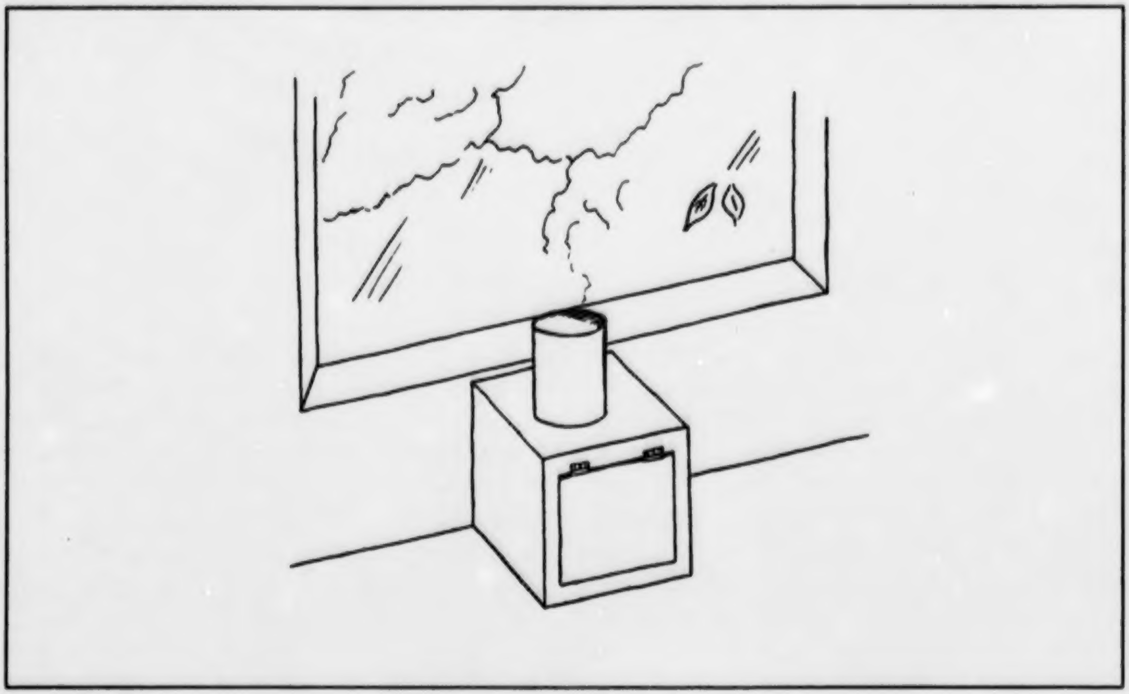


Figure 6. A release hatch is set in the wall of a banding lab, just above the banding table, and just below a window.

8. CAPTURE TECHNIQUES AND EXTRACTION METHODS

There is an enormous variety of devices used to capture birds. The most common methods are discussed in this section. For information on other techniques, consult the Bird Banding Manual, McClure (1984) or Bub (1991).

Traps and nets perform differently from one another and offer banders different opportunities for catching birds. In choosing a capture device, consider what your target species are and what your purpose is. For example, if you want to assess natural body weights, don't use baited traps. If you want to catch insectivores, use nets. If you want to catch ground nesting birds, consider nest traps. Is standardized effort needed in your study? If so, avoid using attractants such as baits or water drips that are hard to use in a standardized manner. Will your target species be more efficiently caught if the trap is at ground level or higher up?

Baited traps attract seed-eating birds only. Their success depends on the availability of wild food, the types of birds in the area, time of year, and the type of bait being used. To many birds, the food offered in a trap is worth the risk of being banded and handled, to the point where they may become "trap-happy," returning again and again to the same baited trap.

Mist nets and Heligoland traps generally provide better (but by no means complete) impressions of the total numbers and kinds of birds in an area than baited traps because they are not as selective. Netting must, however, be done with care and requires close supervision and intensive training.

Nets and some traps can be ordered from reputable suppliers, but most traps are home-made. Necessary materials for trap construction are readily available from hardware stores. Traps are generally made of 1.25 cm welded mesh or hardware cloth and plastic mesh of the same size. A detailed list of materials is given in the Banding Manual.

A few of the most commonly described general-purpose traps are described in the following sections and in the Banding Manual. There are literally dozens of trap types, however, and numerous special-purpose traps for specific species, nesting birds, night use, etc. For an exhaustive treatment of the subject, see Bub (1991).

8.1. Cloverleaf Traps

Wire "cloverleaf" traps (Figure 7) are effective for trapping waterfowl and shorebirds. Floating traps with an enclosed bottom can be used to capture diving ducks, while baited walk-in traps situated in a marsh can be used for dabblers. To catch shorebirds, a much smaller version of the trap (essentially a ground trap) is usually set on a mud flat with one or more lines of short fences or nets to act as leads.

Traps for ducks can be constructed using 1 cm mesh hardware cloth for walls and a heavy fish netting roof. A 3.5 m length of hardware cloth will make a chamber 1.5 m in diameter. For more chambers, use copper or galvanized wire to string two lengths of hardware cloth together in a large circle. Leave about 15 cm unstrung at the bottom of each seam, and bend the hardware cloth to the inside of the circle forming two triangular entrances. "Hog-rings" (available from any farm-supply store) are very useful for fastening these traps together, including the fish-netting that is used as the roof. The circle is inverted at each seam to form two chambers and the fish net is strung over the top. A catching box is attached to one end of the trap.

You can have as many chambers (cloverleaves) as you want, but there are usually only two or three. The more chambers, the bigger the trap. The bigger the trap, the more risk there is of injuring birds. If there are no predators in the area, and the trap is set for ducks (not shorebirds), then the trap can be set in place and left overnight. When arriving to band the next morning, one person enters the trap, and herds the ducks toward the open catching box. Birds are taken one by one from the catching box, banded and released. If predation is a possibility, then baited, live-traps should be deployed around the area to relocate any mink, skunks or raccoons.

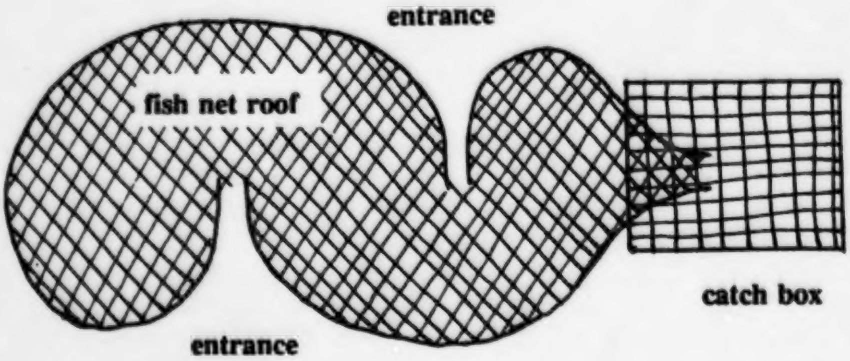


Figure 7. One design for a cloverleaf trap; top view showing entrances, catch box, and fish net roof.

8.2. Heligoland Traps

This trap originated in Helgoland (the proper spelling), Germany. It is a huge funnel-shaped trap (Figure 8) made of wooden posts that support a weld-wire mesh or plastic netting (the latter is preferred for the walls, though weld wire makes for a better roof). The Heligoland trap is designed to catch migrating landbirds over a long, narrow area such as a peninsula, ridge, narrow strip of vegetation, or some similar formation where birds are liable to concentrate. Banders walk toward the open end, herding birds into the trap opening and ultimately into a catching box which is situated at the end of the funnel. Heligoland traps are among the most efficient ways to catch large numbers of birds. The Heligoland can be run in almost any weather, by one person if need be, and the trap does not have to be closely monitored throughout the day, providing that the catching box door is kept in the closed position.

The vegetation along the Heligoland ridge should be kept in its natural state, but as you near the trap entrance, vegetation should taper downwards in height so that it is slightly shorter than the entrance, getting shorter further into the funnel. The trap itself tapers in height, down to about 1.5 m high at the catching box. About 2 to 3 m from the catching box, the funnel bends and a ramp leads up to the catch box door. The bend slows birds down so that they can enter the catching box without injuring themselves. The front of the catching box is made of plexiglas or clear plastic sheeting, set at an angle to prevent injury; birds fly into the "open" box thinking they can get through it.

To set the trap, nothing has to be done. It is effectively always ready to run, providing that the arm holes in the catching box are closed. If catching seed-eating birds, the funnel entrance portion of the trap can be lightly baited. Two to four people are ideal to run the trap, although a successful run can be made with one person. Drivers form a U-shaped line; the outer people walking about 8 m ahead of the others. Pishing, clapping and hollering as you walk towards the open end of the trap will herd the birds ahead of you. Don't worry if some birds break behind the driving line; this is bound to happen. About 3 m from the entrance, gently herd the birds into the funnel. As you approach the far end of the trap interior, pull the string that opens the catching box door and herd the birds up the ramp and into the catching box, closing the catching box door behind them. Again, some birds will escape during the herding process, but this is normal and they will probably be caught on the next run. Never chase a bird for so long that it becomes exhausted or cuts itself trying to squeeze out of the mesh. Indeed, a catch of 10 birds is quite sufficient, so don't risk undue stress or injury by trying to catch large numbers. As always, you are not out to set any records for how many birds you can catch.

Remove birds from the catching box gently and quickly. Do not stand in front of the plexiglas because this will scare the birds deeper into the catching box where they'll be harder to remove. Instead, stand off out of sight to the side where the arm access holes are. The differently sized shelves of the catching box should automatically separate birds of different sizes, but if for some reason smaller birds should get caught up on the same shelf with larger birds, always remove the smaller ones first.

When you are finished banding for the day, close the trap by ensuring that the catching box door and arm holes are closed. If the catching box door is left open, birds can catch themselves and will probably die. Some lazy banders think that it's OK to leave the door open during the course of the day, even hoping to catch the occasional bird incidentally. They're **WRONG!** Keep the catching box door closed at all times, except when you're actually conducting a drive, and you'll save yourself a lot of grief and a lot of criticism.

Although the material needed to build a Heligoland is quite expensive and its construction is labour intensive, the trap is extremely safe and effective when used properly in the right kind of habitat. A Heligoland requires little maintenance if small problems are seen to right away. The plexiglas should always be clean and dry, in order to lure birds into the catching box. On foggy or frosty mornings, the glass must be cleaned off before you make your first run. Repair any holes in the walls or roof, occasionally trim or plant vegetation, and maintain any skulk piles (piles of sticks used to attract skulking birds).

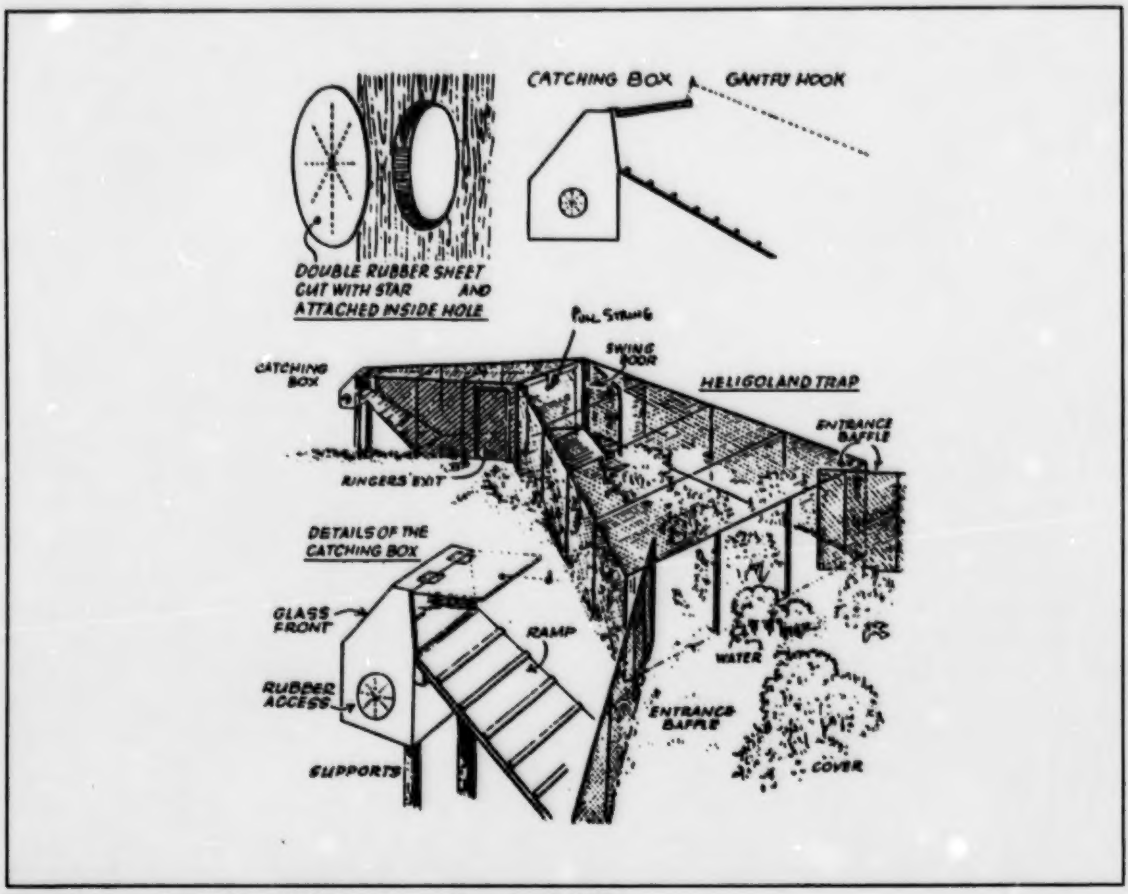

CATCHING BOX
GANTRY HOOK
DOUBLE RUBBER SHEET CUT WITH STAR AND ATTACHED INSIDE HOLE
PULL STRING
SWING DOOR
CATCHING BOX
HELIGOLAND TRAP
ENTRANCE BAFFLE
RINGERS' EXIT
DETAILS OF THE CATCHING BOX
GLASS FRONT
RAMP
RUBBER ACCESS
WATER
ENTRANCE BAFFLE
SUPPORTS
COVER

Figure 8. One design for a Heligoland trap (from Davis 1981).

8.3. House Traps

A house trap is essentially a large square cage equipped with a bander's access door and a catching box at the end of a ramp inside the trap (Figure 9). These traps were traditionally clad with chicken wire or 1 cm metal hardware cloth, but plastic netting is much better since it eliminates any risk of injury. Funnels around the base of the trap allow seed-eating, ground-feeding birds to enter. If the roof is made to slope, 10 cm to 30 cm slots in the central furrow in the roof will allow blackbirds or crows, respectively, in to feed. The trap is baited on the inside and sparingly baited at the funnel entrances to attract birds.

Before setting the trap, it's a good idea to leave the bander's access door open for the first few days, so that birds can find the seed and get accustomed to entering the trap. When setting the trap, close the bander's access door (the door should be built so that it can be latched open or closed). You can leave trapped birds there to lure others, but birds should not be left for more than an hour, or if large numbers accumulate. To extract birds, walk in the bander's access door and close it behind you. Use the draw-string to pull the catch box door open. Then, herd the birds up the ramp and into the catch box. Extract the birds in the manner described for the Heligoland trap.

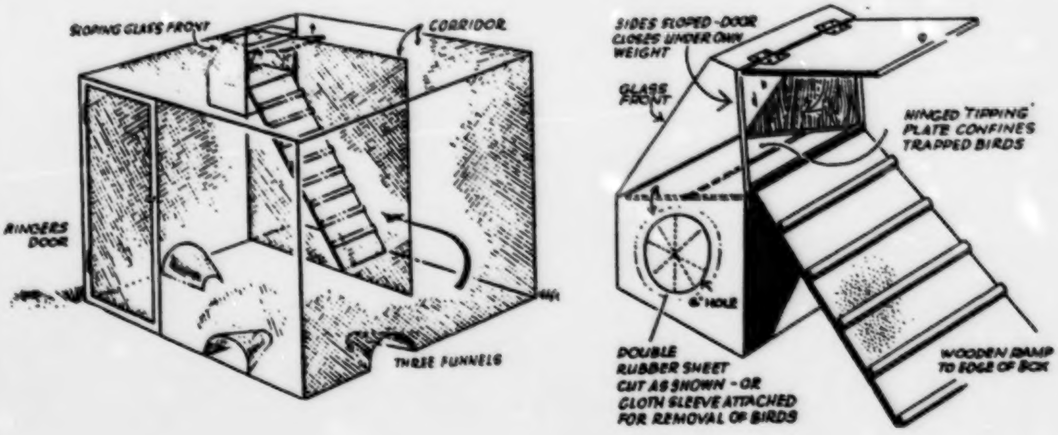

SLOPING GLASS FRONT
CORRIDOR
RINGERS DOOR
THREE FUNNELS
SIDES SLOPED - DOOR CLOSES UNDER OWN WEIGHT
GLASS FRONT
HINGED 'TIPPING' PLATE CONFINES TRAPPED BIRDS
6" HOLE
DOUBLE RUBBER SHEET CUT AS SHOWN - OR CLOTH SLEEVE ATTACHED FOR REMOVAL OF BIRDS
WOODEN RAMP TO EDGE OF BOX

Figure 9. One design for a house trap (from Davis 1981).

To unset the trap, **latch** the bander's access door **open** to allow birds to freely come and go. Make sure that the catch box door is **closed** so that birds are not inadvertently caught.

The grass inside house traps should be kept very short and the entrance funnels should be kept clear of excess vegetation. Fix any holes in the mesh as soon as they occur and keep the plexiglas clean and dry, especially on frosty or foggy mornings.

8.4. Ground Traps

Portable ground traps (Figure 10) are used to catch small ground-feeding, seed-eating birds. They are best made out of 2.5 by 1.25 cm welded wire mesh and measure 1 m by 0.7 m. Ground traps are baited with seed scattered in the centre of the trap and lightly around the entrance funnels. As in the House Trap, birds enter through the funnels and cannot figure their way out again. Birds are extracted through a hinged door on the roof of the trap, but be sure your free hand blocks their escape.

To set the trap, simply close the access door in the top of the trap. As with the House Trap, put seed out in the trap locations a few days before you wish to begin banding to give birds time to find the food. Traps should be checked every 30 minutes to reduce the risk of predation and because some birds will struggle to get out once they have fed.

Because the birds can still feed while trapped, ground traps can be used on cold days, but they should be checked very frequently. If birds are getting wet or cold, trapping should stop.

Traps are closed by simply turning them upside down, or preferably, by carrying them back to the banding station where they won't tempt would be thieves. Maintenance is simply a matter of repairing any holes in the mesh as well as any sharp edges that may develop. The traps can be plastic coated, or a layer of plastic mesh can be laced into the inside of the trap in order to eliminate the chances of any cuts.

8.5. Potter Traps

The Potter trap is an automatic, versatile baited trap made of 1.25 cm by 2.5 cm hardware cloth (Figure 11). It can be constructed to any size specifications depending on the target species; a 10 cm square entrance door is large enough for robins. It is generally used to capture seed-eating birds, but can be adapted for gulls and even shorebirds.

The trap is usually baited and then set by raising the entrance door and hooking a wire attached to a treadle underneath the bottom edge of the door. When a bird steps into the trap, it triggers the treadle and the door falls closed. Potter traps must be reset each time a bird is extracted and watched closely if there are any known predators in the area. When not in use, traps are returned to the banding station. Traps can be operated singly or in series, keeping in mind that they catch only one bird at a time.

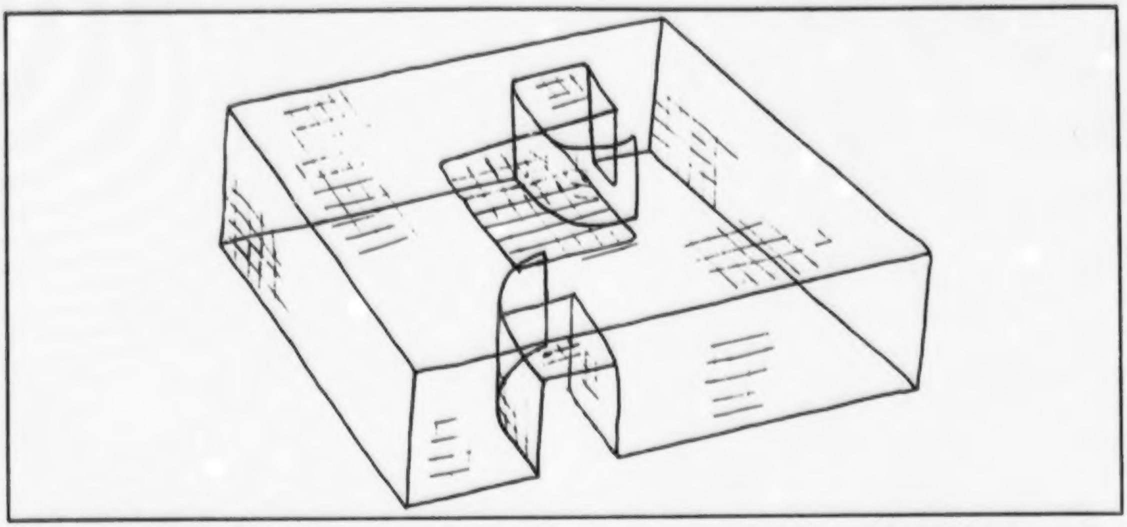


Figure 10. One design for a ground trap, showing two funnel entrances on the sides, and the bander's access door on the top.

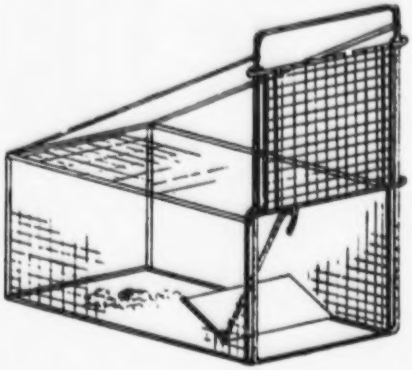


Figure 11. One design for a Potter trap (from Bub 1991).

8.6. Bal-chatri Traps

Bal-chatri traps are used only for catching strong-legged raptors (Figure 12). When a hawk or owl lands on the trap, monofilament nooses entangle its legs and toes. The trap is usually fashioned into a square, circular or conical cage to hold a live lure (e.g. a mouse). The traditional Bal-chatri is a 10 cm high by 20 cm wide cage. Up to 60 nooses are attached to the top and sides of the trap and the trap is set out in an open field or roadside to attract hunting raptors. The trap must be anchored to the ground or weighted so that trapped birds can't fly away with the trap.

The cage can be made out of 1 cm hardware cloth. Sections of 2 kg (4-8 lb) test fishing line can be cut to form loops 3-5 cm in diameter. The loop is formed using a slip-knot and is tied to the mesh. If held out from the mesh while a drop of liquid cement or quick dry glue is placed on the anchoring knot, the noose will stand outright from the trap.

These traps must be tended constantly in order to prevent injury to the legs of the trapped bird. Hence, the bander sits and waits until a bird has been caught and then immediately frees it from the trap and bands it. Nooses must be maintained in working order and any holes or sharp edges that develop on the trap should be repaired immediately. Lure mice must be treated humanely. This includes providing them with sufficient food and water, minimizing the time they must spend adjacent to predators, and releasing them safely when their "job" is done.

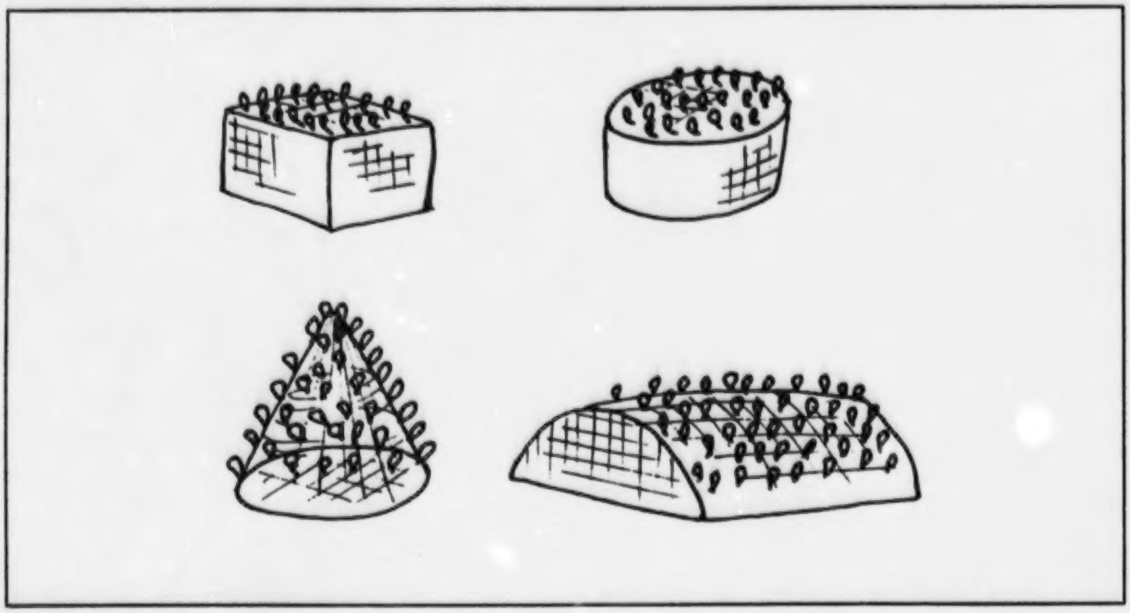


Figure 12. Several Bal-chatri trap designs.

8.7. Mist Nets

Mist nets capture a wider variety of species than most traps but they require more training, dexterity, skill and experience to use safely. No one who becomes easily angered and frustrated should ever attempt mist-netting, as the extraction of entangled birds requires patience.

The nets are large panels of either nylon, terylene (polyester) or monofilament mesh. Shelf strings of thicker, stronger thread are woven through the mesh at the top and bottom of the net and at equal distances in between. Each shelf string ends in a loop designed to fit over a pole. The net is strung between two poles which hold it upright and taut. The shelf strings form the shelves and pockets of the net and tether the mesh at the top to prevent the net from blowing down to one end during high winds (Figure 13). Birds fly into the net, fall into the pockets and become trapped.

Terylene (polyester) nets are preferred by most banders for their strength, durability and design even though they are more expensive and harder to obtain than nylon nets. Good quality nets have deep pockets, meaning that they catch and retain more birds than the cheaper kinds of nets.

Mesh size is measured by stretching the net diagonally and measuring the diagonal distance of the mesh. Different meshes have different catching efficiencies for each species, so mesh size must be carefully chosen to suit your study and reported in any publications. In general, the size of the target birds decides which is the most appropriate mesh size to use. A 30 mm (1-1/4") net is used to catch small to moderately sized birds (e.g. kinglets, wrens, warblers, sparrows, thrushes); 38 mm (1-1/2") nets are used for flickers, Blue Jays, small hawks and owls; and 60-100 mm (2-1/2" to 4") mesh is used for larger hawks. If a small species of bird gets caught in the larger mesh nets or in a monofilament net, it's apt to get badly tangled. It should be removed immediately, with great care. Incidentally, monofilament nets should never be used by banders other than those who have completely mastered the mist-netting technique.

8.7.1. Problems Unique to the Mist Net

Here are some things to watch for:

(i) Nets are notorious for catching on everything and then tearing. Wear the simplest clothing with the fewest buttons, zippers and velcro possible. Do not wear any jewellery. Watch that hats, eye glasses and binoculars do not become entangled in the mesh.

(ii) Nets can catch animals other than birds. Bats are frequently caught in the evening and before sunrise. Since they are capable of inflicting a painful bite, and since bats have been known to carry rabies, you'll want to handle bats carefully. Bats can often be removed from a net just by dumping them out of the pocket. If that doesn't work, then you'll have to grab the bat firmly by the back of the neck with one hand, while the other works to free the netting. Don't be intimidated by their snarling and horrific grimaces. Release bats away from the net site.

(iii) Nets can catch humans too! Caution the public coming to view your banding operation and post signs if necessary. Beware of people carrying umbrellas, walking sticks, fishing rods, etc. Holes in nets not only reduce your catching efficiency, they can also be dangerous to birds.

(iii) Nets will catch large insects, especially June bugs and dragonflies, which cannot always be removed alive or unharmed because they get the mesh caught up in their mandibles or wings. The best way to remove a badly entangled insect is to crush it first, quickly and humanely between two rocks, sticks or between your fingers.

(iv) Nets can attract predators, which can not only injure birds but also damage your nets.

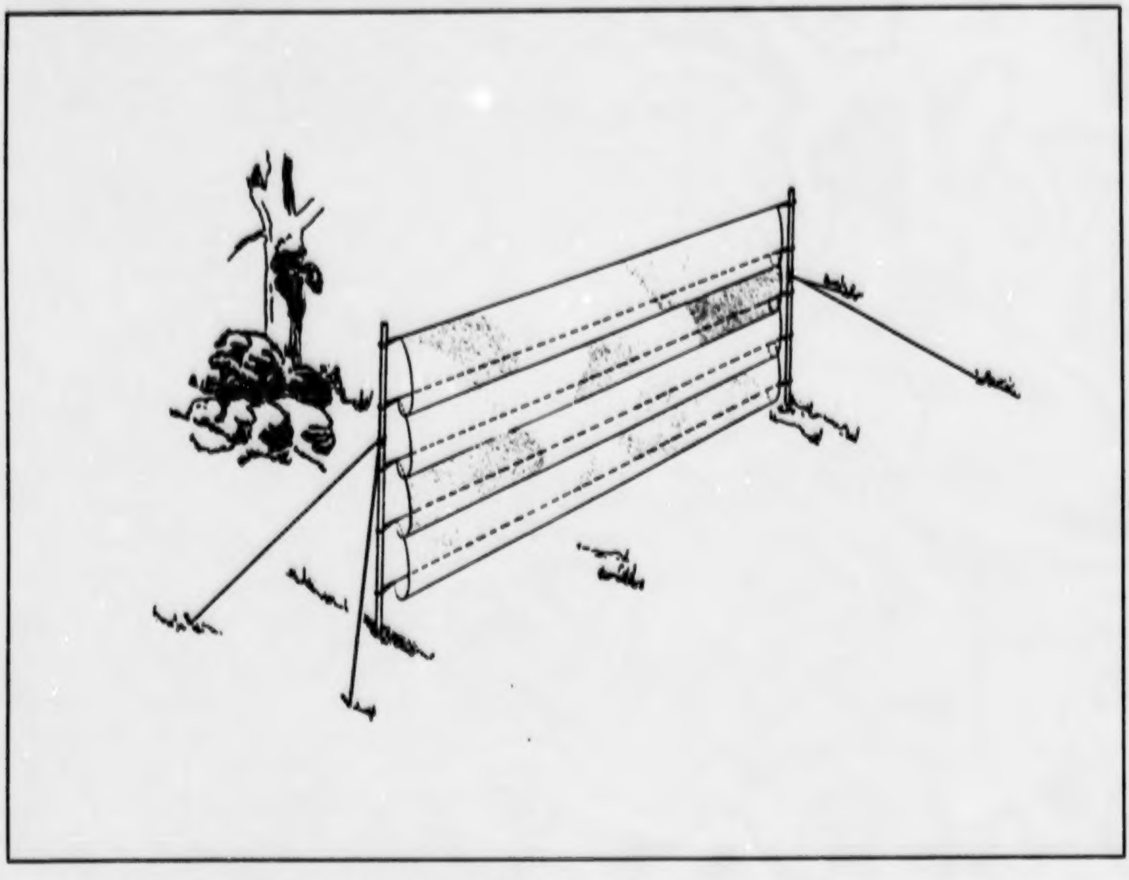


Figure 13. A mist net set up ready for catching (from Lowe 1989).

8.7.2. Setting Up and Taking Down Mist Nets

Before setting up a mist net, a suitable site should be selected. You'll need to consider likely movements of birds, vegetation structure and height, accessibility, slope, type of ground surface, and public access. Once the site has been selected, the netting area needs to be cleared of vegetation. A cleared space of 1 m should be left at each side and at both ends to allow proper access to all parts of the net. Set up is easiest when two people are involved.

(i) Carefully remove the net from the bag and find one set of shelf string loops. A white loop usually identifies the top shelf string, which is usually doubled and tethered with small knots spaced at regular intervals. Tethering prevents the netting from blowing downwind. With one set of loops in one hand, carefully hold all of the mist net securely under one arm.

(ii) Separate the loops, one by one, and arrange them in sequence so that no shelf strings are crossed. Remember, the white loop (the tethered top-line) goes on top.

(iii) Take one net pole and slip the loops over the pole, keeping the white loop on top, and the other loops in sequence. If soil conditions permit, stick the pole in the ground as far as it will go. Support the pole with a double guy line.

(iv) One person holds the first net pole, while the other person walks towards the end of the net lane, gradually letting the net out. Never let the net touch the ground; it'll catch on sticks and leaves and wind up being a real mess. You'll invariably find that out for yourself at some point.

(v) Once at the other end, separate the loops, one by one sequentially, again making sure that the white one is at the top and that there are no twists or tangles in the shelf strings. With the loops in order, place them onto the second pole.

(vi) Pull the net taut, and poke the second pole securely into the ground. Guy it properly and adjust the tension of the net if necessary. The top shelf should be taut, not slack. Check to make sure that the poles are completely vertical, not leaning. Leaning poles are hard on nets and provide uneven tension. New nets are apt to stretch after a few days, so the poles will periodically need to be repositioned in order to keep the net taut. Learn to tie proper knots (e.g. clove hitch, half-hitch) when guying the poles so that repositioning is simple (Figure 14).

(vii) If there are no twists in the net, it can be opened. Unless you are tall, you will need to use a stick to raise and lower the top shelf string. Always push or pull the shelf string **loops** up or down the mist net pole, **not** the shelf strings since they will break. Likewise, lift loops away from the pole to avoid abrasion and wear. When the net is opened, the bottom shelf string should not be low enough to sag and touch the ground with the weight of a bird in the bottom pocket. Use a couple of bird bags to test this. As a general rule, pockets should be about 4-6" deep. The other panels are opened accordingly; no pockets should overlap and there should be no tension on the vertical panel supports of the net. If it is windy, the net should be set even more loosely or birds will bounce out. Figure 13 shows a mist net which is properly set.

(viii) Untended nets should not be left unfurled or left open overnight. To close nets for the day, simply furl and tie them shut or take them down completely. Before furling a net, first make sure there no birds or other objects (twigs, leaves, insects) in it. Lower all upper shelf strings to where the guy rope attaches to the pole, leaving the top panel about a foot above the rest. Raise all the lower panels up to meet the other loops, still keeping the top pocket open. Grasping the shelf strings near the loops, twirl the entire net so that the lower panels are furled into the pocket of the top panel. Then lower the top shelf to meet the others and give the whole net one or two extra furls. Tie the net shut with ribbon or flagging tape at either end and at two or three places in the middle. If half-bows are used to tie the ribbon or flagging tape, the knot can be very quickly undone with one hand. Without these ties, the loops and shelf strings can separate, particularly if a guy line on a pole should for any reason ever loosen or fail (more common than you might think). Even a small separation in the loops can open the net at one end sufficiently to trap birds by accident. Moreover, ties guarantee that the nets will never become unfurled by a gust of wind or jostling from passing animals. This furling technique is fast and ensures that no birds are ever caught by accident. It also results in a furled net that is very easy to re-open. In a pinch, you can "lock" the furled net by hitching the top loops down over the others.

(ix) To re-open a net, simply undo each tie and place the ties between one loop and the mist net pole. This will keep them from blowing away or getting misplaced. Carefully raise the upper shelf string on both poles; do not place any tension on the vertical panel supports. This should cause the lower panels of the net to simply roll out of the upper pocket. Arrange all shelf strings as described above for setting the net up for the first time. The net usually unravels itself. If it does not, it could be caught on itself because there is a hole in the net, or it was opened when there was still frost clinging to the mesh, or there is a stick or an insect entangled in the mesh, or because a shelf string or vertical panel support has broken. When the net will not spring apart on its own, and if all objects have been removed from the mesh, use your fingertips to tease the tangle free. Don't just yank it!

(x) Taking down a net is simply the reversal of the steps taken to put it up, though there are several techniques. Before you begin, open the net and inspect its condition, noting this information on a slip of paper that you'll later enclose with the net. Now close the net but don't furl it or it will be hard to put back up again at a later date. Simply close the net by bringing all the loops together. Take the loops off one pole in sequence and secure them together (in sequence) with a piece of ribbon or flagging tape. Walk toward the opposite pole, looping the net into a bag (a cloth bird bag or plastic shopping bag) as you go. Secure the shelf strings of the opposite end of the net in the same manner. If the net is dry, it can be safely stored inside a cloth bird bag or plastic bag. If it is wet or damp, it must be dried out thoroughly before storing; otherwise it will quickly mildew and rot. Label each storage bag with mesh size, net length and condition.

Do not use nets if it is raining, very cold (below freezing or when your hands are too cold to band), or very windy at the net site (> 25 km/h). Once set, nets **MUST** be checked frequently. This usually means every 20-30 minutes. That is, the net round should begin no longer than 30 minutes after the start of the previous round. Yes, you're going to be busy!

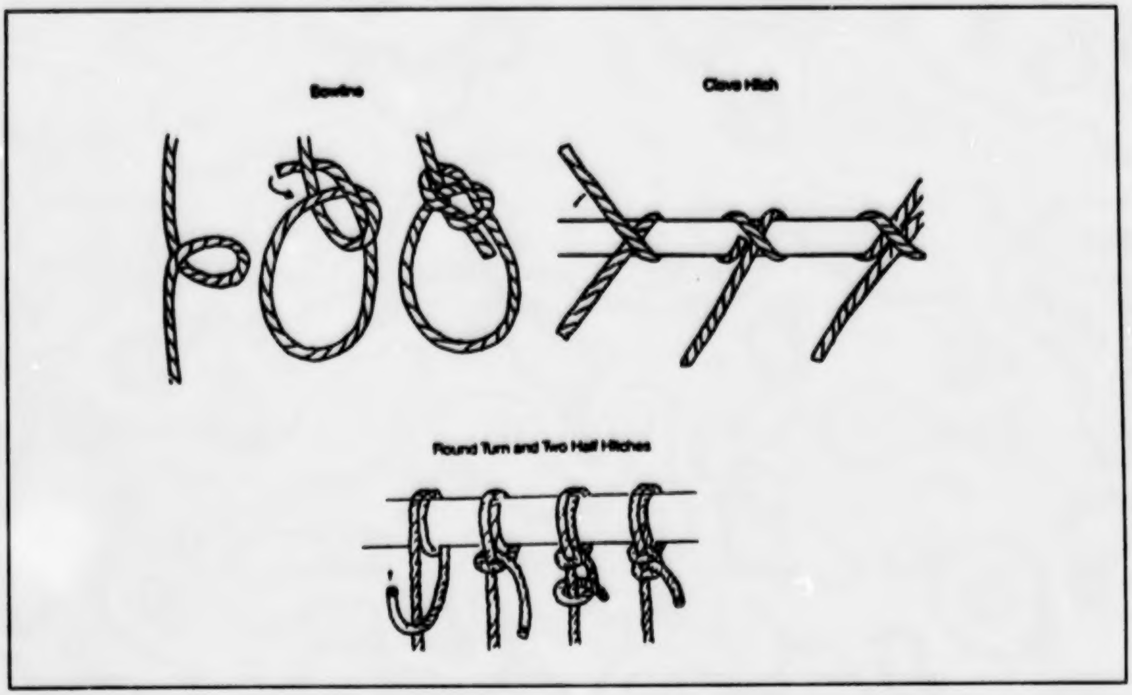


Figure 14. Common knots used to guy mist net poles.

8.7.3. Extracting a Bird from a Mist Net

Most birds will fly straight into a mist net and be so initially surprised that they will not immediately start to struggle. After a few minutes, the bird will begin to grasp with its feet and flutter its wings. The longer a bird is left in the net, the harder it will be to get out. This is particularly true of smaller birds which can fit part of their body through the mesh. For this reason, nets should not be left for more than 20 to 30 minutes between checks. Moreover, the longer a bird is left in a net, the greater risk there is of predation or from it suffering from exposure. Always minimize the risks to netted birds.

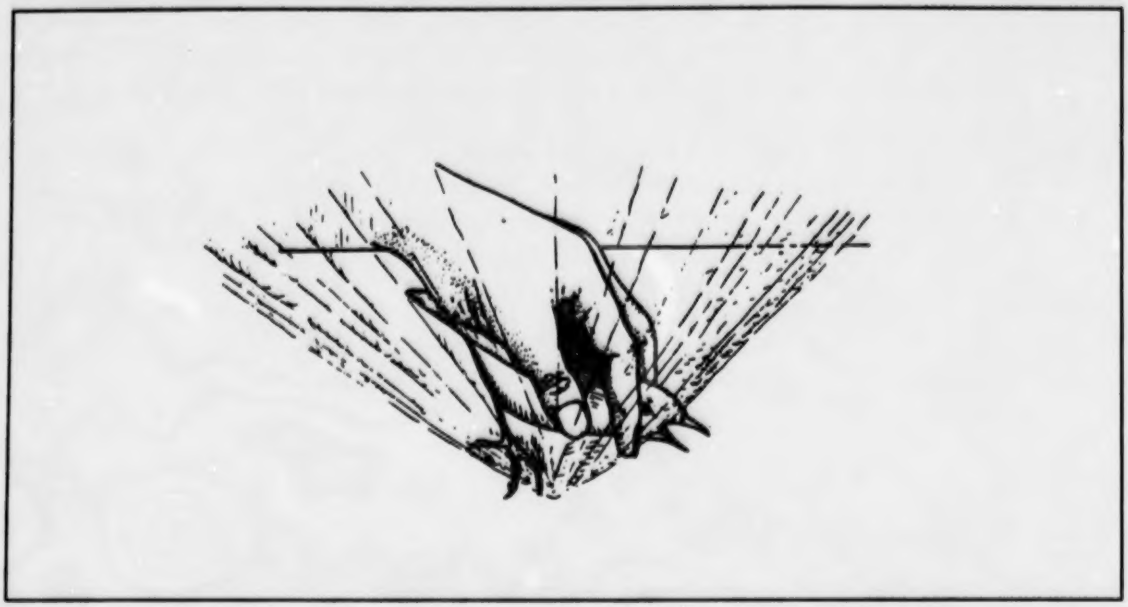


Figure 15. Removing a bird from a mist net using the bander's grip straight away (from Spencer 1992).

Removing a bird from a mist net is an art, though it's really mostly a matter of common sense and logic. Net extraction must be learned under the supervision of an experienced person. Much of what is described here will make more sense when you have seen it done a few times.

Removing a bird is normally a one-person proposition — two people trying to work together is seldom very successful. Trainees should remember this and keep their hands off the bird and net unless specifically called upon by the person removing the bird.

Different banders frequently have slightly different ways of extracting birds. In all techniques, the key to good extractions is a light touch. Part of learning how to extract birds is learning their habits and getting familiar with how different species react and entangle themselves. It takes a lot of practice to master extraction techniques, but you'll eventually develop a "feel" for the process. If trainees have excessive difficulty in developing these skills within a reasonable amount of time, however, they should consider that their time might be better spent using traps only, or concentrating on helping out mostly as a scribe. Not everyone has the dexterity, eyesight, patience and ability necessary to become proficient at mist net extractions.

What follows is a generalized account of how most extractions are performed. Since the bird is flying forward when it hits the net, its tail and legs should be the last things to enter the pocket. This is where the extraction begins. Extraction is easiest if you simply reverse the process of entry.

(i) Approach the net quietly. If many birds are caught, don't panic. Call for assistance if you require it. Assess the situation. First, look for any birds that are in distress. Are any birds double-pocketed, or caught by one leg only, or are there large and/or aggressive species lying next to small ones, or are any birds hanging on the ground? Begin by calmly and efficiently removing the high-risk birds first.

(ii) Determine from which side the bird entered. This is done by seeing to which side of the shelf string the pocket hangs. If the bird has just been caught, it may be lying on its belly in the pocket of the net and can be quickly extracted by placing it in the Bander's Grip right away (Figure 15) and removing it. Otherwise, place the bird in the bander's grip or the photographer's grip, and look for a patch on the belly that is free of mesh — a "clear belly." Check that mesh is not hidden underneath the body feathers. Work from this side of the net or you will worsen the situation. Throughout the extraction process, you'll find it helpful to occasionally blow on the bird's feathers to reveal strands of netting.

(iii) Securely grasp the bird by the legs in the Photographer's Grip, letting the net support the rest of the bird. If there are threads caught up on the bird's thigh, pull these down toward the foot. If the threads are caught too tightly on the thigh, then leave them for now.

(iv) Bird legs are designed so that when they are folded during perching, the feet are locked in a closed position. When the legs are extended during "take off" the feet naturally relax and open. With the bird in the left hand and in the Photographer's Grip, gently use your right-hand fingers to extend the legs and "roll" the net off the feet and toes with your fingers.

(v) Once the legs are free, continue holding the bird in the Photographer's Grip and try to free the wings. As the bird strikes the net, it will fold its wings. Hence, it is the bend in the wing (the carpal joint) that often goes through the mesh, at least part way. Sometimes the mesh will ride down the primaries of the wing. In this case, it is often a good idea to pull the mesh farther down and off the primaries, then back up and over the carpal joint. The mesh may be tight, but the careful use of a seam ripper will be very helpful to lift away hard to reach strands of mesh. Never force the mesh over the joint or up the feather shafts. This can cause tissue or feather damage. If the net is lying loosely on the wing, or if it is a small bird, the net can simply be lifted over the carpal joint. Use your best judgement and disentangle the easiest wing first.

(vi) After freeing one wing, decide whether it will be easier to remove the net from the head or the other wing next. If the opposite wing is freed easily, then change your hold to the Bander's Grip so that more of the bird's body is supported when you start to work on the head. This will also minimize the bird's struggling and make extraction that much easier.

(vii) Removing mesh from around the head is fairly easy, but it may take a little while to develop the knack. This step is likened to the removal of a turtle-neck sweater. The hardest part is to locate the exact opening(s) of mesh through which the bird has put its head. Once you have found this, hold the bird in the Bander's Grip and use the thumb of your right hand to press the bird's upper mandible down towards the fingers of your left hand. With your forefinger of your right hand, hook the net up and over the bird's head (Figure 16). If the bird is large like a thrush, watch that you don't injure the eyes and that there are no pin feathers to catch on the net.

(viii) Once the extraction is complete, place the bird into a clean bird bag, make sure that its in the bottom of the bag, and then loop the drawstring shut.

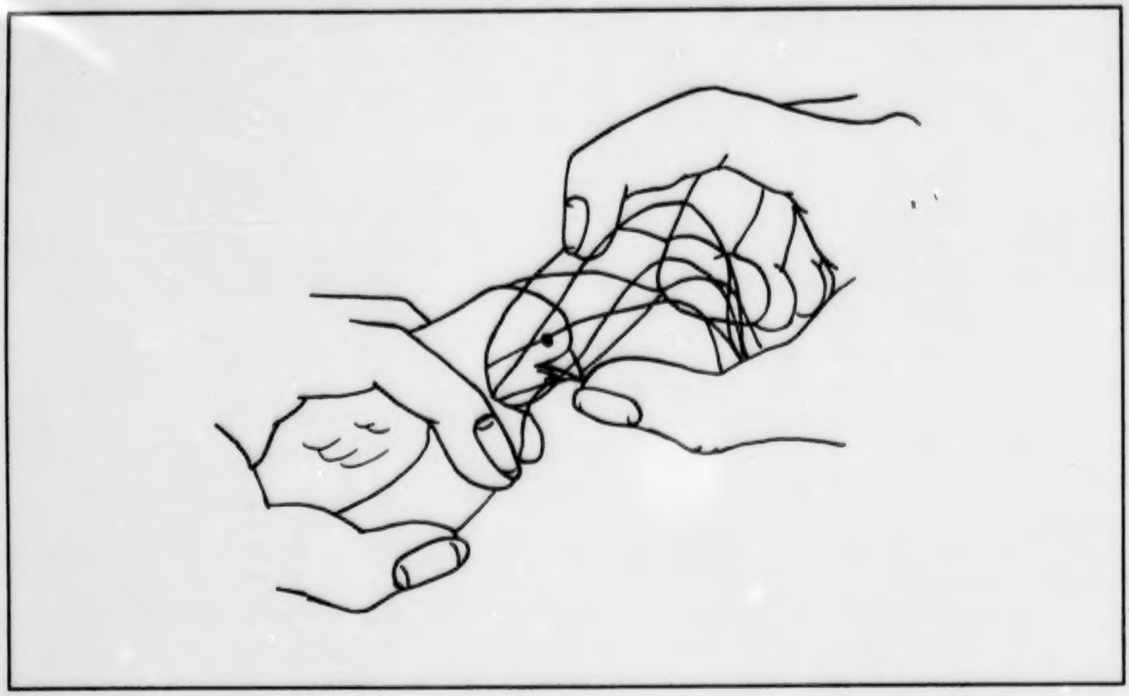


Figure 16. Removing mesh from around a bird's head.

8.7.4. Tricky Extraction Situations

There are many variations of the procedure outlined above. Some of the most common situations are outlined below. Naturally, if you run into any kind of difficulty, **ALWAYS** get help from a more experienced bander.

If the bird has spun in the net, unwind the spin with your fingers as you begin the extraction and continue unwinding as you work.

If at the very start you cannot seem to find the "bare belly" or decide from which side the bird entered, free the feet and legs to give you a clue. Sometimes a small bird will enter from one side, struggle and make it part way through the mesh, then flutter and re-enter from the opposite side. Freeing the legs and feet may make it easier to see the bare belly patch. Beware of mesh concealed under body feathers of the belly and be equally aware that if the mesh is caught high up on the bird's thigh, it may appear to be covering the belly.

If the bird is caught in one pocket and weighs the net so that it hangs down to overlap another pocket, it could become "double-pocketed." That is, its head, legs and possibly wings could be entangled in two pockets. Remove the mesh from the outer pocket first, then deal with the pocket into which the bird actually flew.

If the bird has gone through the net at a hole in the mesh, be patient. It may have flipped up and around another shelf string, twisted, become double-pocketed or any number of other twists and flutters. This can be the most dangerous extraction situation, and after extracting a bird from a hole in the net you will realize the need for frequent net repairs.

During most extractions, switch to the bander's grip as soon as you can, because when the bird feels itself being freed, it will begin to struggle and flap more. When extracting a raptor, grab the legs securely, being careful of the talons. Get it into the ice-cream cone grip as soon as possible. Because the toes are large and the raptor will grip at the mesh, the feet may be badly entangled and strands may have to be picked off one by one.

Some birds have strongly arrow-head shaped tongues. When a bird gets "tongued," it has bitten down on the net and the mesh has slipped around the fork at the back of the tongue. Hold the bird in the bander's grip, then pry the bill open with your fingers. At this point, a seam ripper is really handy to carefully pull the threads backward, off the fork of the bird's tongue, and out of its mouth. This can be a delicate situation and is often left as the last step in the extraction. Proceed slowly and be gentle, all the while keeping the net tension-free. It is sometimes helpful if one person holds the bird, while another frees the netting from the tongue.

All banders should carry around a seam ripper, plastic toothpick or nail clippers to help free up those hard to get at threads. A seam ripper (or similar object) should be considered an indispensable piece of your banding equipment. And while we're on the subject, we should also mention that a good bander almost never has to cut a bird out of a net. Holes can pose a risk to other birds that are subsequently captured. Cutting netting is used only as a last resort (e.g. when injury is occurring to the bird that will only worsen with more handling and/or when the most experienced bander on hand is unable to quickly free the bird). Even then, it is used judiciously and sparingly. Trainees **MUST** seek help from more experienced banders before cutting a bird out of a net. If you do have to cut a few threads, make entirely certain that no mesh is left hidden on the bird.

Last but not least, if extraction takes a long time (more than a few minutes) and the bird is exhausted, release it immediately unbanded. There's really no point in putting it through any additional stress. Again, trainees MUST always seek and get assistance from more experienced banders whenever they are faced with extraction difficulties.

8.7.5. Net Maintenance and Disposal

Check frequently that guy lines are tight and that the net is clear of vegetation and other debris. Protect loops on nets with a wrap of silver duct tape; they'll last much longer and will be unlikely to fail and potentially injure a bird.

If a panel support or shelf string breaks, weave an entirely new line with thick nylon thread in place of the old one, anchoring it to the proper loops using an overhand stitch. A seam ripper or large blunt embroidery needle will help immensely. Do not simply tie two broken ends of a shelf string together or the resulting line will be shorter and the net will not hang properly. Moreover, the mesh will have a propensity to get constantly fouled and tangled on any knots.

If a hole develops in the net, repair it immediately with thin nylon thread. To fix a hole in the mesh, cut the loose ends of the broken mesh back to about 3 mm before the previous knot. Using simple overhand knots and a piece of wood or plastic the width of the mesh, you will be able to repair the mesh by tying knots in the right spots, the right distance apart. The procedure for mending various sized holes is depicted in Figure 17.

If nets have to be taken down when they are wet, hang them to dry at your earliest convenience. This will prevent fungus and mould from weakening the net. Nets do not last forever. However, bits and pieces can be salvaged before a net is disposed of. For example, a four-panel net with holes in only one panel can easily be converted into a three-panel net. Loops can also be salvaged for the repair of other nets. Old nets should be burned rather than thrown in the garbage. This ensures that no unauthorized person can ever work with them and also ensures that no animals will get accidentally entangled.

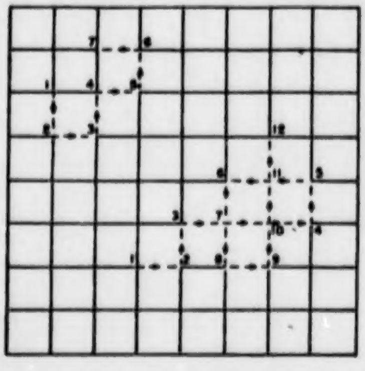


Figure 17. Repairing small holes in a mist net. Arrows show the direction of the movement of the needle (from McClure 1984).

8.8. Cannon Nets

Cannon nets are used for capturing large numbers of birds (e.g. feeding flocks). They are particularly useful for catching cranes, herons, waterfowl, gulls, shorebirds and turkeys.

Large, strong fishing nets made of about 20 m^2 of light material are folded and lined up in front of three or more cannons. Bait may be placed in front of the net to attract the birds. Cannon cylinders are attached to the free end of the net and loaded inside the cannons. The cannons are set to go off and, provided the net does not catch on anything and the cannons go off simultaneously, the net will rise smoothly and come down over the flock of birds. The opposite end of the net is anchored to the ground, using rubber attachments to cushion the tension.

When operating this net, use the utmost caution. Once the cannons are fired, you will have no control over the net. The edges of the net or the cannon cylinders may hit and injure a few birds if the flock is densely concentrated, so it is important that the cannons are fired at the proper moment and that they all go off simultaneously. Cannon nets are capable of catching many hundreds of birds at a time. Therefore, the bander should over-estimate the number of assistants needed and have adequate banding equipment on hand for quick processing. If too many birds are captured for the size of crew on hand, then the excess number must be released immediately without bands.

Cannon netting can be very frustrating. Banders must practice firing the cannons to familiarize themselves with the feel and range of the net. Triple-check the net to make sure it is folded properly and not caught on anything. Bait must be placed close enough to the cannons that the net will cover the birds, but not too close to the cannons.

Incidentally, because explosive charges are used, cannon netting is not without hazard to the people involved. Be careful. All banders must have thorough training from an experienced cannon netter before attempting to use this type of net. Cannon netting requires special authorization from the Banding Office.

9. PREVENTING BIRD INJURIES AND FATALITIES

A "casualty" is defined here as any injury (serious or not) or death. In any good banding operation, each and every banding casualty is judged not just as an unfortunate accident, but rather as a heart-breaking experience. You never really do get used to casualties, and we've seen even the most experienced banders fight back tears.

Although very rare, birds can be injured or even die in even the most careful banding operation. So what is an "acceptable" rate? While the **goal is zero**, in actual fact the risk can never be completely eliminated, if only because there is always going to be a risk of predation. Still, a general rule of thumb is that if your casualty rate exceeds 0.5% (i.e. more than 1 casualty for every 200 birds banded), then you must reassess your operation.

Banding casualties are usually due to predators, bander inexperience, bad practice, or faulty equipment. A simple combination of common sense, forethought and awareness minimizes the risk of casualties. For example, when approaching a net or trap, you must quickly assess the risk of injury to the captured birds. Always remove either the largest or smallest birds from a trap first (depending on which are fewer in number), because the larger birds could injure the smaller ones. Priority must also be placed on removing any bird that seems to be experiencing difficulty. Don't forget birds in holding boxes or bags. Use bird bags inside out so that claws do not get entangled in the seam threads.

The following sections provide a number of other points which will help focus your attention on preventing casualties.

9.1. Mist Net Selection and Use

Mist nets must be of the right mesh size, of good quality, in good condition, and monitored correctly. Mesh size is important. A small bird in a large mesh net (> 30 mm), particularly if left for any length of time, can get very tangled and requires considerable expertise in extracting. However, if your main target is jay-size and there are very few smaller birds around, you would do better to use a slightly larger mesh size. Your catch will be a lot higher and you won't have birds flying along the bag, not only escaping, but also catching their bands (if retraps) en route.

The quality of a mist net is likewise important. A main consideration is material; the choice is usually between nylon and polyester (or terylene as it is known in Europe). Polyester nets are a little more expensive than nylon nets (at least in the short term), but they are also finer, stronger, stretch less and are more resistant to damage by sunlight. Because of their durability, they are more resistant to holes and thus safer to use on birds. They also last longer and therefore cost-effective in the long-term.

Although monofilament nets are durable and very effective, we strongly discourage their general use. They can injure birds unless the bander is exceptionally skilled and tends the nets at exceptionally frequent intervals (e.g. every 10 minutes). Special training in the use of monofilament nets is highly recommended.

Other factors that affect the way netting behaves are the diameter (denier) of the component thread and the ply number (the number of threads that are braided into each strand). The bulkier the strand, the less tangled birds get and the easier they are to extract. As a rule of thumb, it is advisable to go with a heavier mesh (say 75 denier, 3-ply rather than 70 denier, 2-ply). The catching rate will be a little lower than for lighter weight material, but extraction will be quicker.

It's amazing that a few banders still insist they have no fatalities when a) tending nets at **hourly** intervals, b) leaving nets open untended overnight, and c) not tying their nets closed at the end of the day. While we do agree that casualties are infrequent in such set ups, we are acutely aware that they do happen. Since it is the job of all banders to minimize all risks, they must always expect the unexpected. For example, if you leave nets open all night or untied, expecting that you'll be on-site first thing in the morning, what happens if your car breaks down or you fall ill? And what are your nets going to look like the morning after a large animal goes through the site, or if there's a night hatch of June bugs, or if a bat, flying squirrel or Great Horned Owl gets captured overnight?

9.2. Trap and Catching Box Design

Well-designed traps are usually safer to use than mist nets, but even so there are a number of factors to be considered in order to minimize casualties. Most traps are made from welded wire mesh or plastic netting. Do not use chicken wire since it has a tendency to damage birds. In general, the material selected should be of the largest mesh size that will contain the target species and of the best quality. Welded wire mesh measuring 1"x½" is generally considered to be the optimum mesh size for songbirds. If birds regularly scuff their foreheads, consideration should be given to coating the wire with a suitable plastic coating. Any edges of wire traps that birds can come in contact with should be cut and bent back in such a way as to avoid any sharp points (this is appreciated equally by hands, sweaters and down jackets!). Alternatively, large framed traps should be clad with plastic netting, which is cheap and easy to install. It obviously will not withstand a snow load when used as a roof, nor will plastic walls take heavy abuse. Still, in the interest of bird safety, plastic mesh is clearly the material of choice.

Large traps should incorporate a catching box into the design to help you extract birds quickly and safely. Angle the top plate at 45° to deflect a fast-moving bird and make the transparent surfaces out of thin plexiglas or (better yet) heavy plastic sheeting instead of glass. Plexiglas and plastic sheeting will "give" a lot more than glass, especially if it is installed loosely. You should also place a branch or two just in front of the box to slow birds down. Finally, arrange some grading device in the holding box to keep large birds from trampling on the smaller ones. A simple method is to install a middle shelf inside the holding box. If this shelf is recessed away from the plexiglas by a distance of about 40-50 mm, then sparrow-sized birds will slip between the gap down into the lower compartment, leaving larger birds in the upper compartment.

9.3. Weather

You should not mist net during rain, snow, sleet or when it is very hot (>30° C), very cold (<4° C), or if the nets are exposed to very windy conditions (>25 km/h). Anticipation of and response to deteriorating weather helps avoid casualties. Birds in nets are far more vulnerable to inclement weather than those in traps, because they are exposed to the elements. For this reason, mist-netters must be acutely aware of the current and imminent weather. Be prepared to close up before it starts to rain.

9.4. Bird Numbers and People on Hand

When deciding how many nets or traps to open, you should balance the number of birds you anticipate catching against the number and skill-levels of people on hand. You should be especially cautious when operating at a new site, particularly if it is one likely to concentrate migrants. Some or all nets and traps must be closed in response to large numbers of birds. You are **not** out to set records. Whenever you encounter a situation where you cannot safely band the number of birds you are catching, you must let some go unbanded and you must immediately close down some or all catching devices.

9.5. Injuries and their Causes

9.5.1. Minor Cuts and Scrapes

Small cuts may bleed profusely for a little while (as with humans), despite their non-severe nature. Although cuts and scrapes are not life-threatening, it is your responsibility to ensure that birds are treated as humanely as possible.

(i) Forehead Abrasion in Traps

When birds enter a trap, they eventually discover that they are caught, and then try to get out through the mesh. If the mesh is made of metal, this can sometimes result in forehead abrasion. It's not a serious injury, but should be minimized by selecting the most appropriate size mesh, plastic coating it, or replacing metal mesh with plastic mesh. As always, traps should be checked regularly.

(ii) Cut Legs

Small cuts to legs (usually thighs and toes) can result from rough handling or inattentiveness during mist net extractions. Thought should also be given to using thicker and/or extra-ply nets which will be less abrasive. Monofilament nets are especially hazardous.

(iii) Feather Bases

As with legs, this is the result of rough handling or inattentiveness during net extraction, but less abrasive nets will help. Recently fledged juveniles and moulting birds are especially vulnerable because the bases of their incoming feathers are soft and blood-filled. The netting is apt to get tangled around these incoming feather shafts and unless you are careful, it is easy to break the shaft.

(iv) Tongues

Birds sometimes get "tongued" in mist nets. Some species (e.g. thrushes), are more prone than others. Providing that a seam-ripper, or failing that, a small twig or grass stem is used to free the loops of netting, no damage usually results. Heavier netting is kinder on tongues than finer nets, as well as being easier to tease off.

9.5.2. Problems with Legs

Very rarely, a bird will be found with a broken leg in a net. This is usually caused by some external force being applied to the net, effectively stressing the leg at the wrong angle until it breaks. The external force can originate from high wind or from another (usually larger) bird that is caught in the same panel of the net. Less often, it is a result of a banded bird being "hung up" by its band in a net due to a mist net strand slipping under the band. The latter can be eliminated by making sure that bands are properly closed. Frequently inspect your banding pliers to make sure that they are not so badly worn as to prevent full band closure. If they are worn, they must be replaced. Broken legs can also occur during mist net extraction if the tarsi are held too low; these occurrences are inexcusable.

Leg dislocation is rare, but some species (e.g. White-throated Sparrow) seem more prone than others. Most dislocations can be quickly treated by straightening the leg and popping the joint back into its socket.

Legs can be crushed if an incorrect (small) band size is used or if the bander has failed to notice that the band is starting to overlap during band closure. Banders and trainees must be meticulous in band selection and application. If a choice of band sizes is given, use a leg gauge before selecting a band. Do not guess.

"Leg Cramp" is an imperfectly understood phenomenon that appears to be restricted to long-legged shorebirds (e.g. curlews, godwits and oystercatchers). An affected bird is incapable of walking properly, yet is able to fly strongly. Leg cramp may be caused by loss of structural and functional integrity of muscle fibres when muscles are over-strained. Why some birds should be affected in this way is not understood. Analysis of some reported cases suggests that females may be more susceptible than males, and fat birds more than those of normal weight. Similarly, it has been suggested that birds in poor physical condition (one case involving moult, another endoparasites) may also be susceptible. Practices for minimizing the risk include aiming for small catches of these long-legged birds, removing them from the net or trap very quickly, not putting them in bird bags, not carrying them with the legs folded against the body but fully extended, and using traps (and holding boxes) that are about 1 m high (allowing birds to stand up fully). Processing long-legged shorebirds should be given priority and be as swift as possible.

9.5.3. "Wing Strain"

Occasionally, on release, some small birds (up to thrush size) appear to be incapable of flight, preferring to flutter along the ground. Such symptoms are commonly referred to as "wing strain." The condition is popularly believed to result from slight muscular strain or bruise. It is probably caused while the bird is in the net when one wing is free but the other is tangled and exerting a lot of pressure against the net. It can also occur during the extraction process. X-rays of some cases have shown a fracture of the coracoid bone. In all likelihood, however, this fracture is caused during the release process when wing-strained birds are released from too high an aspect over hard ground. A flightless bird is prone to landing on its sternum. For this reason, all small birds must be released carefully (and from a low height) in case they are unable to fly.

It seems that small birds are most susceptible to wing strain. All banders and trainees must be aware of the anatomy of birds' wings and how they may and may not be manipulated. Any bird that is caught up primarily by one wing must be immediately restrained in the bander's grip.

Unless a joint has been dislocated, most cases of wing-strain are temporary, and the bird will usually recover its capacity for flight within an hour. However, because of the risk of predation, wing-strained birds should be recaptured and held in a quiet, warm, dark place for a while until they recover. You can usually gauge a bird's flight capability by holding it in the photographer's grip and gently "jolting" it up and down, making it flutter.

9.5.4. Stunning

Providing that the appropriate steps are taken to minimize the chance and severity of impact with catching box surfaces (see Section 9.2.), stunning should never occur in traps. Stunning more commonly happens when a bird escapes in a banding lab and hits a window. For this reason, banding labs should be small and not have opposing windows. Plastic netting can be installed over windows if need be. It is also a good idea to leave outside doors open so that any escapees are able to quickly find their way outside unharmed. Naturally, escapes will not happen if you are attentive and using a proper grip.

9.5.5. Shock and Torpor

Very small birds (hummingbirds, kinglets and sometimes warblers) occasionally appear to go into a state of shock, especially if they have been over-handled. It is usually only a temporary phenomenon, provided that the bird is suitably treated (see section 3.4.3.). It can be minimized by ensuring that birds are not over-handled and by being attentive to any signs of distress. Try to revive and release such birds as quickly as possible, unbanded if necessary.

There are some tell-tale signs that should alert you that a bird may be in distress: opening and closing the bill ("panting"), gaping, closing eyes, lying limply, and fluffing up feathers. Birds showing any of these signs should be handled as little as possible, assessed as to their capacity for flight and released immediately if flight is likely. More often than not, the bird will surprise you and fly away normally. If flight is judged unlikely, then distressed birds should be put in a warm, dark quiet place and periodically checked. As a general rule for songbirds, if recovery is going to occur, it usually happens spontaneously within an hour. Reassess the situation if the bird has not shown signs of recovery after this time.

9.5.6. Tail Loss and Feather Damage

As part of a bird's strategy to avoid predation, tail feathers are not firmly anchored. Not surprisingly, tail loss is probably the most common kind of "injury." It usually happens when you try to grab at an escaping bird, although it can also occur when placing birds in bags and not ensuring that the bird is in the bottom of the bag before tightening and looping the draw-string. The appearance is certainly worse than the condition, since healthy birds are often seen with little or no tail as a result of predator attack or very rapid moult. Still, it places additional energetic stress on a bird and is easily minimized with careful handling.

Frayed and broken feathers are other kinds of feather damage that can occur and need to be minimized with careful handling. Also be aware that the natural oils on your hands can gum up feathers. Keep your hands clean and dry. Never handle birds if you have applied mosquito repellant to your hands! It may be toxic and is highly corrosive.

9.5.7. Eye Damage

Sharp wire projections on wire traps could puncture a bird's eye. Also, while trapping in sub-zero temperatures, an eye could freeze to the wire mesh. Eye damage can be easily prevented by ensuring there are no sharp projections left during trap construction, and/or by covering the trap with a suitable plastic coating.

9.6. Causes of Death

9.6.1. Strangling

It is extremely rare for a bird caught in a well-set net in good condition to get strangled. In general, it only happens if the bird's head and neck are somehow pulled taut by the netting. The likelihood increases when the net has many holes or if the mesh size is incorrect. It is also increased by large catches at one time, when a heavy bird is captured under a smaller one, when the bag setting is too generous, or in conditions which are too windy. Pay particular attention to birds captured and "missed" in the bottom panel; check the entire length and breadth of your nets. Needless to say, strangling could also occur as a result of rough handling during extraction, which is totally inexcusable.

Be aware that a particularly dangerous potential for strangling occurs when a high shelf string is stretched down in order to extract a bird, and then is accidentally released. In order to safely access birds in nets, shelf strings should be pulled down at the loop on the net pole. Many banders choose to pull the string down by hand and secure it firmly under an arm. However, this isn't good practice (the shelf string can accidentally slip out from the grip) and should not to be encouraged. Also, pay particular attention when two people are extracting birds from the same net at the same time. Each of you must be aware of the other's actions and act so as not to pull any netting away from the other's bird. Communicate!

9.6.2. Predators

It is not sufficient merely to treat predation as being an acceptable "natural phenomenon." The effect of predators on a mist-netting operation is two-fold. The obvious result is that birds are injured or killed. The second effect is that the predator often damages the net, which unless repaired immediately, poses a threat to subsequent captures. As in other matters, anticipation, alertness and swift action by a good bander minimizes the risk.

Banders must be continually on the lookout for avian predators. Should the presence of one be noticed, nets should be checked more frequently, but failing that, nets should be closed. If present, hawks and owls will gladly try to avail themselves of the "free lunch" offer presented by birds caught in mist nets. Other species may be equally dangerous — you should watch out for jays, magpies, shrikes and even grackles. No bander can prevent occasional predation by an itinerant raptor or jay, but if a number of predators are known to be present in the banding area, and particularly if one or more individuals learn what mist nets can provide, then there is no alternative but to close some or all of the nets until the problem has gone away. Indeed, sites that concentrate raptors at certain times of the year may regularly have days when mist-netting for songbirds is precluded.

A number of mammals can prey upon birds in nets and traps (e.g. fox, weasel, raccoon and skunk). Other mammals can occasionally harm birds in nets too. Squirrels and chipmunks and even deer and porcupine have been known to nibble at birds. As with avian predators, banders must always be alert to the presence of known or potential predators. If a problem occurs, steps must immediately be taken to prevent its recurrence, such as making exceptionally frequent checks of traps and nets, or by raising the nets so that captured birds are out of reach. If the problem cannot be contained, bird trapping should cease until the predator has lost interest. You may need to resort to trapping and relocating repeat offenders.

Some species of snakes, such as the Eastern Fox Snake, can also prey upon trapped birds. Their reach can be surprisingly high, and they can climb poles. You should be alert to this possibility and take action (e.g. make frequent net checks, raise nets well above the ground, capture and relocate offensive species) should snakes be seen near nets. Please don't kill snakes!

9.6.3. Haemorrhage

Birds have higher blood pressures than mammals. Extreme nervous excitement induced by excessive handling may be sufficient to produce haemorrhaging. There are even reports of birds dying from ruptured blood vessels when involved in prolonged territorial disputes. Although haemorrhage is extremely rare in a banding operation, it may be manifested as traces of blood seen in the mouth or as a slight wheezing, which is an indication of a lung haemorrhage. If symptoms are detected, handling must cease immediately and the bird put in a sheltered, secure place, where it can calm down and depart at leisure. This may take only a few minutes. Subsequent retrapping indicates that some birds behaving this way suffer no lasting impairment. If a bird which has exhibited wheezing has still not left after half an hour, and if the bander has suitable rehabilitation facilities nearby, it may be taken into temporary care.

9.6.4. Heat Exhaustion/Heat Stress (Hyperthermia)

In certain instances, small birds can overheat in mist nets and bird bags. This is easily avoided with forethought and alertness. Don't open nets in direct afternoon sunlight on hot days. If you simply must, then be prepared to monitor the nets closely (every 10 min.) and remove birds as soon after capture as possible.

On very hot days, particularly if combined with high humidity, monitor the captures closely and be prepared to close nets, release birds waiting to be processed, or reduce the processing time.

Never leave occupied bird bags or holding boxes in full sun and always space out bags at the banding location to allow air to circulate among them. Keep bags clean and dry so that air can circulate through them. If birds have had to be doubled up in bags, transfer them to empty bags as soon as possible, so that they don't heat each other up.

Surprisingly, heat exhaustion/stress can also occur on very cold days with cold-adapted species such as Snow Buntings. Consideration should be given to minimize the time these birds spend in a warm banding lab.

Severe hyperthermia (open mouth breathing) can be treated by carefully immersing the body of the bird in cold water, taking great care not to get the head wet. Be aware that excessive cooling can occur if the bird remains wet, so it is necessary to towel dry it as completely as possible, before placing it in a warm, dark place for recovery prior to release.

9.6.5. Cold Exhaustion /Cold Stress (Hypothermia)

Birds are prone to cold exhaustion/stress if they have little or no fat. Fat is a bird's metabolic fuel, and metabolic needs are heightened in cold weather. Even on cool days, early morning captures of small birds with no fat should be monitored closely. As with heat exhaustion/stress, be prepared to close traps, release birds waiting to be processed, or reduce the processing time if exhaustion/stress starts becoming apparent.

All birds with wet or even damp feathers are prone to cold exhaustion/stress at any time. For this reason, mist netting in rain or even a heavy mist is unacceptable. Following overnight dew, nets should be shaken as dry as possible before starting to capture. If a bird gets wet, keep it in a warm, dry place until dry. A sugar-water treatment may be helpful if the bird is distressed.

9.6.6. "Natural Causes"

Just occasionally, a bird is found dead in a net that was recently checked or in a bird bag that was not held overly long before processing. There is no sign of injury or any indication of what may have precipitated the bird's demise. Birds have short lifespans, and for stations banding thousands of birds annually, it is entirely conceivable that one occasionally dies from "natural causes" or old age. However, if mysterious deaths are anything more than extremely rare (e.g. more than 1 in 10,000), you must reassess your entire banding operation.

9.6.7. Punctured Trachea and Crop

There have been occasional reports of seed-eating birds suffering punctured trachea. This can occur if a well-filled crop is pressed too hard against the windpipe. Banders using baited traps should be alert to this possibility. There are also occasions when corn-fed waterfowl caught in large clover leaf traps rupture their crops against the side of the trap. Reducing the size of the trap and/or using plastic or fibre netting will eliminate the risk.

9.6.8. "Exploding" Nestlings

Nestlings will occasionally leave a nest prematurely as a result of disturbance. This departure can be dramatic, leading to use of the term "exploding." An early departure of nestlings can be fatal, particularly if the nest is over or near water. Banders must be cautious during a first time approach to a nest believed to contain young, and be prepared to withdraw at the first sign of potential "exploding." Routine banding of nestlings should be timed to take place before young are capable of leaving the nest.

9.7. Treatment of Injured Birds

9.7.1. Release

Any minor wound should be treated with antiseptic cream or an iodine solution. In most cases, the most humane way to deal with an injured bird is to simply release it. This is best done by placing it in a warm, sheltered and secure place away from any further disturbance. If it has not recovered in half an hour or so, consideration should be given to attempting rehabilitation.

9.7.2. Rehabilitation

Large birds (e.g. hawks and owls) with serious but treatable injuries (e.g. broken wing) should be sent to professional rehabilitators if possible. For smaller species, providing the bander has the facilities and the appropriate permit, an attempt can be made to rehabilitate the bird on site. All that may be needed is a suitably sized cage in a quiet, warm place, equipped with a perch and a plentiful supply of water and appropriate food. If you know nothing about the care and feeding of wild birds, however, send the bird to a professional rehabilitator. All banders should make a point of getting to know rehabilitators in their area.

9.7.3. "Jolting"

“Exhaustion” usually relates to extreme stress, or lack of energy reserves (hypoglycemia). Birds that appear to be in a state of shock or have gone into torpor can frequently be gently "jolted" back to reality. This can be done in several ways. The bird can be held in the photographer's grip and jolted up and down a couple of times, just an inch or so at a time. This coaxes it to flap its wings; wing flap seems to rouse the bird from its day-dreaming. Hummingbirds should be cradled in the hands for this procedure. A couple of puffs of air on the bird's head may help too. If the bird is suspected of heat exhaustion/stress, it can be fed a little 1:4 sugar/water solution. This can be done with a pencil tip or similar object by moving the tip of the bill into the drop. Keep the bird upright and make sure that no liquid enters its nostrils.

9.7.4. Amputation

One-legged birds do occur in the wild. For many birds, it appears to be only a minor handicap, and individuals that have recently lost a leg have been seen to adapt remarkably quickly. For this reason, if a bird suffers a broken leg, and it is felt that healing is unlikely to occur in anything close to the natural position, it is best to amputate the leg at the break with a quick snip of a pair of sharp, fine scissors.

It is best to cauterise the wound quickly afterwards with styptic powder and a styptic stick (available from pet shops). Unless rehabilitation facilities are on-site or close by, it is usually best to release amputees immediately.

Note that amputation is usually only confined to small birds; broken legs on large birds (e.g. Sharp-shinned Hawk size and above) can be more readily healed by a skilled bird rehabilitator. Every effort must be made to ensure that such birds are treated by a rehabilitator.

9.7.5. R & R

Birds which need to be kept for a short while (e.g. for recovery or because weather is unsuited to immediate release) can be kept inside in a well-ventilated box such as a shoe-box. The box should be placed in a dark, warm (25^0 C) and quiet spot until the bird can be released.

9.7.6. When and How to Euthanize

If a bird is badly injured, and rehabilitation is neither feasible nor likely to succeed, the only recourse is to euthanize the bird **quickly** and **painlessly**. This is always a difficult decision and always a heart-rending task. Yet, all banders should receive instruction on how to euthanize birds humanely.

While not recommended with small birds up to the size of a thrush, euthanization can be done by stopping the heart-beat ("thoracic compression"). This is done by pressing the thumb hard against the left side of the bird's breast and holding it there, while simultaneously squeezing the entire chest area with a couple of other fingers. The bird loses consciousness quickly, but it will take a couple of minutes for the heart to stop completely. It is extremely important that pressure is maintained for a few extra minutes until you are absolutely certain that the bird is dead and there is no chance of revival. Veterinarians advise us that the above method is not considered entirely humane, since it requires that the bird become unconscious from lack of oxygen, and death is secondary. Hence, the recommended method for euthanizing any bird is by swinging the bird around quickly, striking the head against a hard surface. Death is instant, but a half-hearted attempt is worse than doing it right the first time. Wringing the neck or jerking the head and body sharply in opposite directions will also work, but it takes more skill. **Never** drown a bird; it is a slow and inhumane death.

Some banding stations keep a tank of pressurized carbon dioxide on site. The CO_2 is first released into an air-tight compartment (e.g. a cooler or plastic bag) and then the bird is put inside, where it quickly loses consciousness.

9.8. Disposition of Dead Birds

Any bird found dead should be checked to see if it is banded, and if so, full details should be recorded. Next, the condition of the bird should be assessed to determine whether it is suitable for preparation as a museum specimen. If so, it should either be skinned within 24 hours or wrapped in a plastic bag or tin foil and then frozen.

Full details of the collection must be recorded: species, age, sex, location, name of collector, and circumstances surrounding the bird's

death all written in waterproof ink or pencil on a card which is then enclosed with the bird. Other information, such as the degree of skull ossification, fat condition, size and condition of the gonads, and body weight can be usefully included too. Dead birds are to be sent to a museum; instructions are supplied in the Banding Manual and on the back of your banding permit. Unless you obtain a special permit, it is unlawful for you to possess specimens.

If the bird's condition or other circumstances preclude skinning or freezing, the bird should preferably be burnt, or buried at a distance so as not to attract the attention of potential predators.

9.9. Record Keeping and Reporting

With the exception of instances of tail loss and minor feather damage, all casualties must be recorded in a logbook. Date, species, type of injury/fatality, likely cause, and treatment are recorded. At the end of the year, all casualties must be tabulated and reported to the Banding Office on the appropriate form.

10. "PROCESSING" BIRDS

10.1. The Essential Basics

Banders must master bird identification and bird "topography". Unless you are 100% sure that the species you are banding has been correctly identified, the bird **MUST** be let go unbanded. Data for a misidentified bird are worse than useless; they are misleading and may contribute to false conclusions based on banding data. Don't be embarrassed to admit that you're not quite sure. You are also not permitted to band sick, injured or domesticated birds, Rock Doves or any of the "chickenlike" species like Wild Turkey, Ruffed Grouse, Ring-necked Pheasant, Northern Bobwhite, Sage Grouse, etc.

Banding is most useful if accurate age, sex, and various measurements and plumage descriptions can be recorded too. After all, by examining live birds, you can learn a great deal about moult patterns, colour variations of races, differential migration times between sexes and ages, and so on. It is every bander's responsibility to record as much information as is safely possible from each bird banded.

Part of being able to correctly identify, age and sex birds is becoming familiar with terminology describing different parts of a bird. You need to completely familiarize yourself with field guides and age and sex keys. A typical passerine is depicted in Figure 18, along with the names of the various feather tracts, soft parts and skeletal joints that you really do need to know.

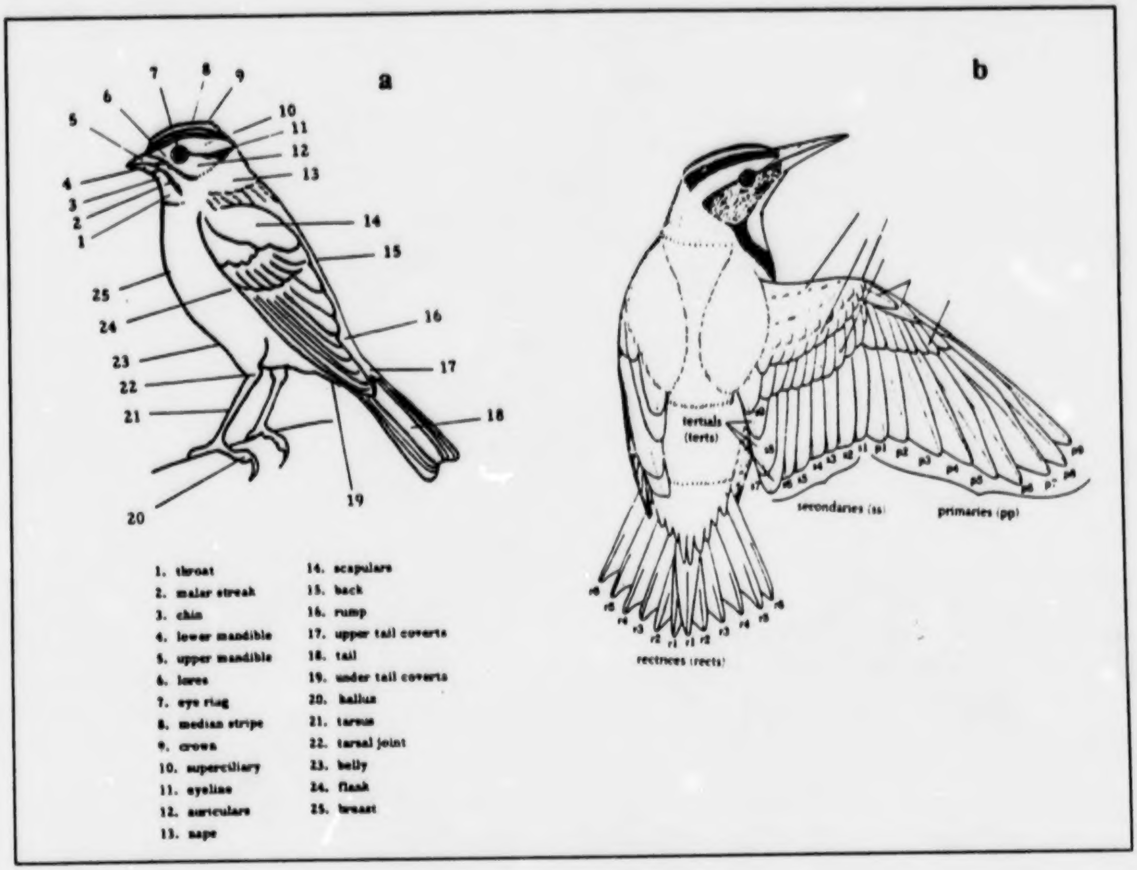

a
b
1. throat
2. malar streak
3. chin
4. lower mandible
5. upper mandible
6. lores
7. eye ring
8. median stripe
9. crown
10. superciliary
11. eyeline
12. auricular
13. nape
14. scapulars
15. back
16. rump
17. upper tail coverts
18. tail
19. under tail coverts
20. hallux
21. tarsus
22. tarsal joint
23. belly
24. flank
25. breast
tertials (terts)
secondaries (ss)
primaries (pp)
rectrices (rects)

Figure 18. Topography of a typical passerine. a) side view b) top view (from Pyle *et al.* 1987).

10.2. Band Fit and Size

Every band size is given a number or a combination of a number and a letter to designate its size, ranging from 0 to 9C. Like shoe size, this number is for naming only; the actual size of the band is measured by its inside diameter. Band size selection is naturally governed by the size of the bird's leg.

Generally, a band is said to be a good fit for the bird's leg if, when closed properly, the band is able to rotate and slide freely up and down the tarsus without slipping up past the metatarsal joint, or without slipping down over the bird's foot. Loosely fitted bands may slip and constrict the toes so that the bird cannot grasp with its feet, or catch the hind toe between the leg and the band, or slip onto the tarsal joint so that the bird cannot bend its leg. A band that is fitted too tightly can damage a bird's leg. Keep in mind that tarsi are usually flat or elliptically shaped and that the band is fitted to the widest part of the leg.

Based on the above criteria, the Banding Office recommends a certain band size(s) for each species. These recommendations, should be followed unless you feel that the recommended band size is inappropriate for the particular bird that you are banding. There can be a good bit of variation in leg width among individuals of certain species (e.g. Common Grackle), and their legs should always be gauged for the correct band size. A record of this must be made in your field notes and on the Banding Schedule, noting why the "wrong size" band was used (e.g. large leg, hence this band size). If you accumulate experience suggesting that a different size band would better suit a particular species, submit this information to the Banding Office and publish your findings. If the band is a poor fit, it should be removed (see Section 10.8).

10.3. Types of Bands

All standard bands provided by the Banding Office are made of a light-weight aluminum alloy. Butt-end bands are designed for general use on most species, with the exception of large raptors. These bands are available in all sizes and are issued unless another type is specifically requested.

Lock-on bands have a special crimping flange to "lock" the band onto the bird's leg. This makes them especially useful for raptors which are capable of removing standard, butt-end bands. They are available in sizes 4 through 9. Rivet bands are used on eagles; they are available in size 9 only. Hummingbird bands are shipped to the bander as a thin sheet of aluminum with the band numbers printed on it. Banders must trim the bands, smooth the band edges and shape the bands before use. Instructions are provided by the Banding Office. Hummingbird bands are denoted as size X.

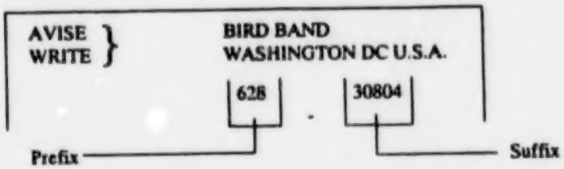
Depending on the circumstances, you may require bands made out of harder metals, different alloys or bands made to other specifications. Birds with strong bills (e.g. grosbeaks, cardinals and crossbills) can remove a band, so bands made of stronger metals (e.g. stainless steel) may be used for these species. To obtain these specialty bands, contact the Banding Office. Often, you'll have to cover the production cost of specialty bands yourself. Uncommonly used alloys and their properties are listed in the Banding Manual. Markers other than the official numbered leg band must be authorized before use and are not normally supplied by the Banding Office.

Coloured, plastic leg bands are available from commercial suppliers (see Appendix 2). Two colour bands can be put on the same leg. You must record which colours are used, in which combinations, and on which leg (right or left).

10.4. The Band Numbering System

Every band has a unique eight- or nine-digit number stamped on it, along with the return address of the Bird Banding Laboratory (Figure 19). On smaller band sizes (sizes 0-1A), the address is engraved on the **inside** surface of the band. Band numbers are made up of two parts: a three- or four-digit prefix and a five-digit suffix. The prefix is a combination of a variable series number and a band-size indicator; the last digit of the prefix indicates the size of the band (as in the table in Figure 19). The suffix is the identification number that, in combination with the prefix, is different for every bird.

Standard bands are strung, closed on wire or string, in multiples of 100. The first band on every string is band # 01 out of that lot of 100 bands. The last band of every string starts the next series of 100 bands. For example, bands of the series 1201-56501 have a variable series number of 120, are size 1 bands (either size 1, 1B or 1A) and are of the series 1201-56501 to 1201-56600. For your record-keeping interests, all bands of a series should be used consecutively. Incidentally, it is common practice to denote the band number's prefix with an underline.



Band Size	Band-size Indicator (last digit of prefix)	Band Size	Band-size Indicator (last digit of prefix)
0	0	4A	4
1	1	5	5
1B	1	6	6
1A	1	7A	7
2	2	7B	7
3	3	7D	7
3B	3	8	8
3A	3	9	9

Band Numbering System

Figure 19. A standard band, labelled for prefix, suffix, return address, band size indicator, and variable series number (from CWS 1991).

10.5. How to Order Bands

Only Master Permit holders may order bird bands from the Banding Office. When ordering hummingbird or specialty bands, banders must include a statement of need along with their permit application or indicate previous authorization. You should order as many bands as necessary to last the duration of your banding project, or 6 to 12 months, whichever is less. It is important to inquire about any unusual band orders well in advance so that your banding operation is not left short.

10.6. Banding Pliers and Other Equipment

A basic checklist of the bander's equipment is as follows:

- banding pliers (different sizes)
- bands (different sizes)
- band string holding device (e.g. film canisters, wire hangers)
- band removal tools (e.g. circlip pliers)
- wing rule
- callipers or dividers
- balance and weighing cones
- leg gauge
- bird bags
- seam ripper (or nail clippers)
- small scissors, pen knife
- magnifying glass
- light source
- black pens
- liquid white out
- data sheets (e.g. banding sheets, retrap cards, moult cards)
- binder/file box for data sheets and cards
- nets and/or traps
- identification and age/sex manuals
- scrap paper
- tissue (to wipe up messes)

A list of banding equipment suppliers is provided in Appendix B.

Small bands (size 0-3) are usually opened and closed using specially designed banding pliers (Figure 20), which are available in a selection of sizes according to band size. They are much better than regular needle-nose pliers or other kinds of closing devices, since they greatly reduce the chances of overlapping bands and harming a bird's leg. Avoid any closing device with serrated jaws, as these can scar the band and obscure band numbers.

Banding pliers have a split pin which is used for opening the band. The band is placed over the pin, with the seam of the band oriented exactly toward the tip of the pliers and even with the split in the post, so that when the pliers are opened, the band opens evenly (Figure 20). This evenness is important since it ensures that the band can also be closed evenly.

A leg gauge (Figure 21) is used to determine the correct band size to be used on those species having more than one recommended band size, or on species with variable leg thickness, or whenever you're in doubt. The thickest part of the bird's tarsus is placed in the slot on the leg gauge which corresponds to the anticipated band size. The gauge is then moved up and down the bird's tarsus to make sure that a band of that size would fit properly. It's always a good idea to try out two or three slots to arrive at the best fit.

A pair of banding pliers has holes in its jaws that fit one or two standard band sizes. When the pliers are used to close a band placed in the correct sized hole, the band will close properly, without overlapping or leaving a gap between the ends of the band (Figure 22). Never use the wrong plier hole for the band size or you risk overlapping the band and crushing the bird's leg. To be on the safe side, make tracings of the pliers in use at your station, labelling the hole sizes for the benefit of trainees.

Large bands and lock-on bands are opened with a pair of needle-nose pliers. On lock-on bands, the flange is bent upwards so that it is perpendicular to the rest of the band. The band can be closed using the correct size banding pliers or a pair of needle-nose pliers, but be careful not to overlap the band. Use pliers to bend and lock the flange in place (Figure 23). Larger butt-end bands can be closed using needle-nose pliers, but large British banding pliers are even better.

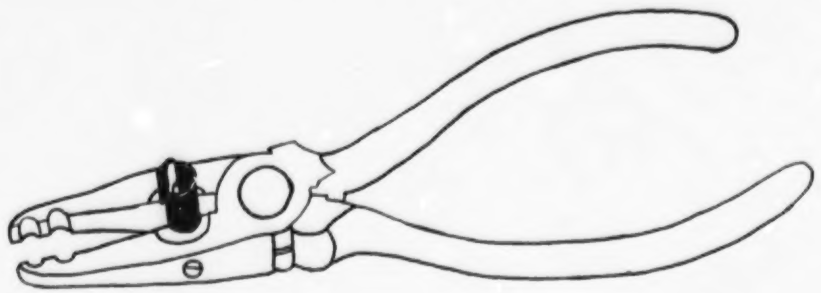


Figure 20. North American banding pliers, showing holes in the jaw and the split pin opening a band.

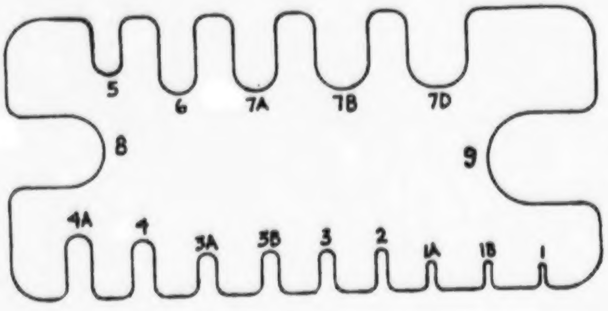


Figure 21. The leg gauge.

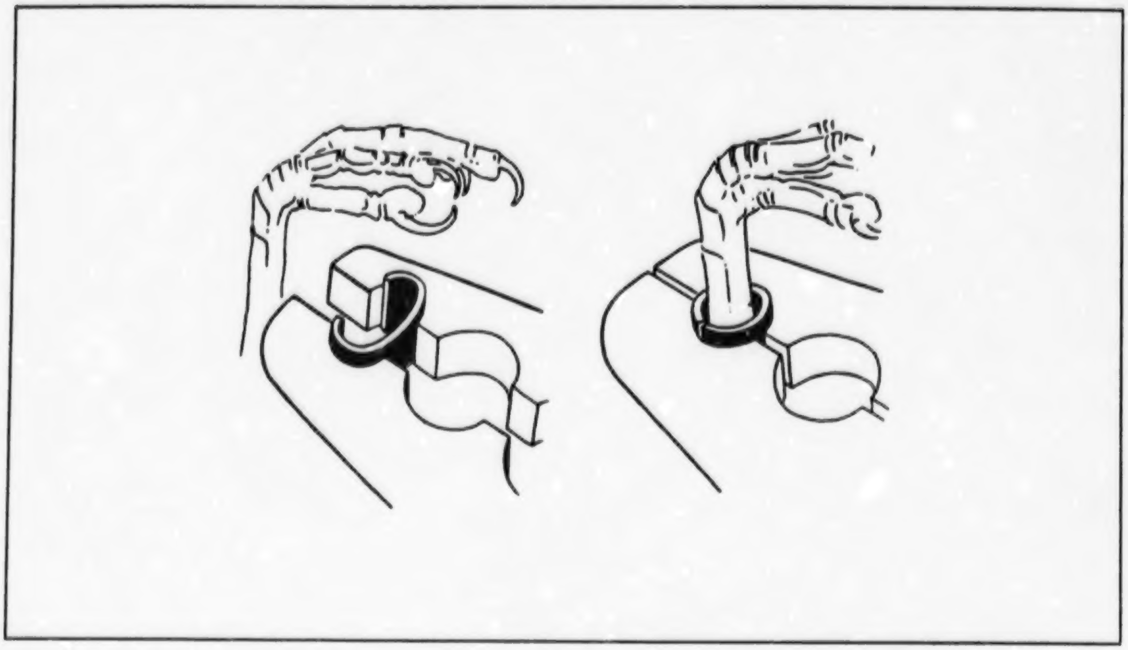


Figure 22. Applying and closing a butt-end band, including the 90° rotation (from Spencer 1992).

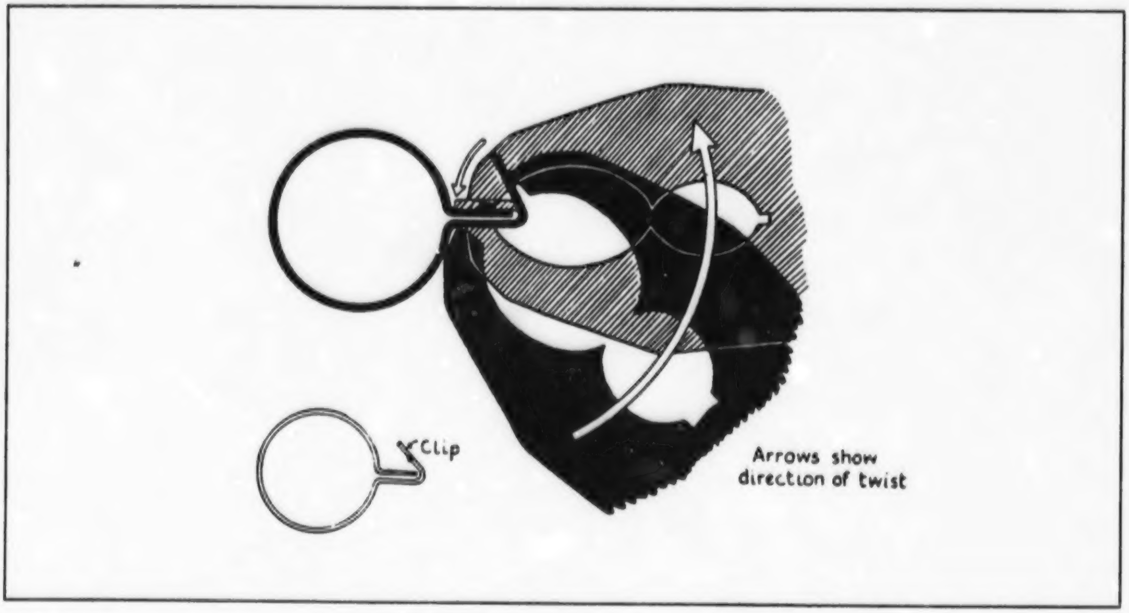

Clip
Arrows show direction of twist

Figure 23. Closing a lock-on band using a pair of British banding pliers (from Spencer 1992).

10.7. Banding a Bird

Before starting to band, trainees must be completely familiar with the data that need to be collected and how those data are to be recorded. It is the bander who tells the scribe the relevant data taken from a banded bird. Under ideal conditions, there will be one bander and one scribe.

After correctly identifying the bird, check both legs to see that it is not already banded. Check the list of recommended band sizes. If one of two band sizes is recommended, or if it is a species which is known for having a variable leg size (eg. Common Grackle, raptors), use a leg gauge to decide on the appropriate band size.

Take the next band of the correct size from the series and read the last two digits of the band number out loud to the scribe. Make sure that bands are used in sequence and that no bands have been lost or missed without record of an explanation.

While holding the bird in the bander's grip in one hand, and the pliers in the other, place the band over the pin on the pliers. First-time banders usually have a little difficulty in mastering the banding operation smoothly without finding a need to set the pliers down. However, it is easy to hold the bird, the band and the pliers all at the same time: the pliers should not be set down until after the bird has been banded. It just takes a little practice and coordination.

Open the band evenly, just wide enough that the band will fit over the bird's leg (Figure 20). Place the band in the correct hole of the pliers with the split in the band oriented toward the tip of the pliers (Figure 21). Firmly pinch the bird's tarsus at the metatarsal joint between your thumb and forefinger (Figure 1). The leg must be supported at the top-side part of the joint, or you risk breaking or dislocating the leg if the bird suddenly struggles. With the band correctly in the pliers, gently slip the band around the leg, below the tarsal joint, and carefully close it, watching that you do not pinch the leg with the band or overlap the band. (Note that all shorebirds and kingfishers must be banded **above** the tarsal joint in order to prevent mud from collecting inside the band and to reduce band corrosion from exposure to salt water).

Open and withdraw the pliers. Now, inspect the band to ensure that the ends of the band firmly abut. If there is any gap, rotate the band 90° and pinch it again with the pliers (Figure 1). This ensures that the band is correctly closed, with no gap between the ends of the band and no sharp edges protruding. If the band is skewed (ends not directly opposite one another), correct this by angling the pliers so that the jaws contact the top and bottom surfaces of the band.

Once the bird has been banded, set the pliers down gently so they are not damaged, and quietly onto a cushioned surface so that the bird is not startled. The aim is to band the bird as quickly, quietly and as carefully as possible, so that it can be released unharmed, having endured minimal stress. As a general rule, there should be no need to handle birds for more than a couple of minutes. A skilled bander is able to process a bird completely (including ageing, sexing and measuring) in about a minute.

Your banding area should be a "Quiet Zone" when birds are being handled. Avoid any loud noises. Trainees should resist their natural temptation to comfort a bird by talking to it or patting it on the head. Birds don't have a clue what you're talking about and are frightened by strange sounds and quick motions. They would doubtless prefer to be released sooner than held for "soothing." Keep in mind that to a bird, even the most well-intentioned and best-looking bander in the whole world looks more like a monster than anything else. Try to put yourself in the bird's shoes . . .

10.8. When and How to Remove a Band

Getting a band safely on to a bird's leg is really quite simple. Getting one off, however, is a little trickier. Bands that are too loose, too tight or worn need to be removed.

A band is subject to constant wear and corrosion from the moment it is placed on a bird's leg. Much of this wear is produced by the simple action of the band moving up and down the bird's leg, and occurs on the inside of the band. It will eventually fall off. Corrosion and wear to the outer, numbered side of a band depends a great deal on the bird's habits. Corrosion occurs most often to bands of birds habituating saline or alkaline waters as well as to bands that come into frequent contact with faeces. In time, the number becomes illegible.

Overlapped and incorrectly sized bands must be replaced too. If, however, an incorrectly sized band will rotate freely and slide up and down without pinching the tarsus or without causing foreseeable injury, then the band should be left alone. Band removal is an extremely delicate process and can itself result in a broken leg. On occasion, it may be better to slightly "oval" a band which is marginally too small rather than risk band removal, especially if you are on your own.

Circlip pliers are frequently used for band removal, because they have fine angled tips, enabling their insertion between the band and a bird's leg. The tips fit on either side of the band seam. When the handles of these pliers are closed, the tips of the pliers open, thus opening the band (Figure 24).

When removing a band, all leverage must be applied to the band and none to the leg. As during banding, the metatarsal joint must be supported throughout the whole process. If the band is loose enough, use a pair of circlip pliers. Insert the tips of the pliers so that they are on either side of the seam of the band. Close the handles of the pliers evenly and gently, until the band is open far enough to be taken off the leg.

If the band is too tight against the leg to use circlip pliers, loop two strands of the wire on which bands are strung on either side of the seam of the band, being careful not to puncture the leg. Wrap each end of the wire around a pen or the tips of a pair of circlip pliers (Figure 24) so you don't cut your hands. One person holds the bird, preventing it from struggling and supporting the leg. The other person pulls the pens apart evenly and simultaneously or closes the circlip plier handles. Once the band is sufficiently loosened, the circlip pliers can be inserted to finish things off. Other techniques that are especially useful if you are alone are shown in Figure 24. On very tight fitting bands, you can often pry the band open a little by carefully twisting the tip of a pen knife blade into the seam.

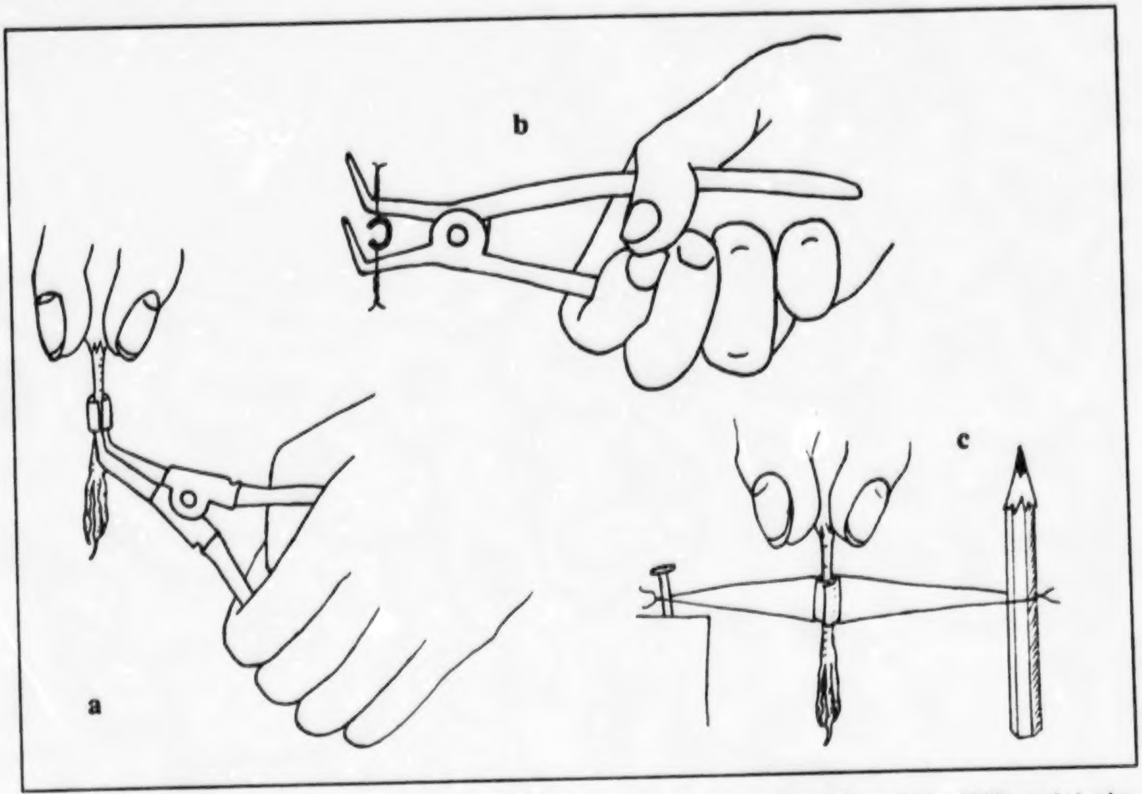


Figure 24. Band removal using a) circlip pliers, b) wire and circlip pliers (adapted from Lowe 1989), and c) wire, pencil and a nail (adapted from Spencer 1992).

10.9. Banding Nestlings

Banding nestlings is necessary for many academic studies. It can also provide tremendously useful recovery information because the age and origin of the birds are known exactly.

Nest finding can be tedious, but there are some tricks. Watch where parents carry food or nesting material, then wait quietly until they have made several trips and you are sure of the location. Never interrupt birds that are building a nest (put the nest location on a map and come back at a later date) or nests containing eggs because birds often desert if disturbed before eggs hatch.

The most crucial thing about banding nestlings is the age at which it is done. This varies with the species and circumstances. Most passerines should be banded when they are about 5-8 days old. Before this, the band may slip off the foot onto the toes. After this, the nestlings will be nervous and may prematurely fledge ("explode") from the nest (see Section 9.6.8.). No nestling should be banded until its leg has hardened and grown to its adult size. If nestlings are banded too early, especially with white colour bands, the parents may mistake the band for a faecal sac and throw it, along with the nestling, out of the nest.

Do not band nestlings that look old enough to explode from the nest. For passerines, the ideal age of minimal risk is when the pin feathers of the wing are fully formed, but when the web of the unsheathed primaries is no more than 1-2 mm. This happens around day 5, so days 5-7 are the best for banding. After day 8, the nestlings may be too old. For blackbird-sized birds, the webbing can be up to 3 mm out, but again, by the 8th day, the nestlings may be too old to band. To help calculate the best age for banding, find out the fledging period, and divide it into four quarters. Band the young in the third quarter. This general rule of thumb is particularly handy considering that there are large variations in fledgling periods for small periods (e.g. as short as 10 days for some sparrows and up to 20 days for chickadees).

Take care when banding nestlings of marsh/water nesting species. If banded too late, they may fledge early and drown, suffer predation, or become so far removed and concealed from the nest that their parents cannot find them. Other references should be consulted for information on the banding of non-passerine nestlings.

Do your best not to reveal a nest to predators. Look for avian predators when approaching the nest. Jays and crows may be attracted by parental alarm calls and rob the nest after you leave. To reduce the risk of mammalian predation, use a round-about way of getting to and from the nest, and go late in the day so that your scent is not trapped in dew on the grass.

When removing nestlings, watch that they do not grasp the nest or nest lining. Be sure to check the feet and tarsi before pulling too hard. Count as you remove young, to ensure you put back as many as you got out. Stay at the nest while banding so that the parents do not come back to an empty nest. However, if you're working in a colony, it is better to leave one young in the nest and move away to band the rest, so other birds are not disturbed. It's all right to leave the nest empty for 5-10 minutes; parents don't desert nestlings that easily. But work quickly, being sure that you have all necessary banding equipment ready for use.

Use the bander's grip when handling nestlings, unless they wriggle a lot, are very tiny, or have short tarsi. In these cases, the reverse grip can be used. Large nestlings (crow-sized or larger) can be held in the lap and covered with a cloth, but be sure they don't wriggle away.

Replace all young and do not leave them hanging outside of the nest, even a little. Cover the nest with your hand or a cloth until the nestlings settle down. If some do fledge early, it may be better to just leave these ones and retreat from the nest site. Ensure that all bands are tucked away below the nestlings and out of sight. Otherwise, the adults could mistake the band for a faecal sac and throw it (along with the nestling!) out of the nest. To further minimize the chances of this happening, you could dull the new bands with a couple of dabs from a magic marker. Avoid using white colour bands on nestlings!

In all instances, minimize your time at the nest. Simply band the birds and leave the area immediately, preferably by a different route than you used to get to the nest site. That way your trail does not dead-end at the nest; dead-end trails are apt to give the nest away to mammalian predators.

10.10. Ageing and Sexing

The keys presently used for determining age and sex of North American birds are good, but they are far from complete, particularly in the case of passerines. Banders have a unique opportunity to closely examine live birds and this opportunity should not be wasted. By closely observing many individuals of a species, you may begin to recognize age or sex related features that have not been previously noted. These observations should be recorded and published.

The Banding Office formally recognizes ageing and sexing criteria that have been proven to be at least 95% accurate. Hence, the only keys that are generally considered acceptable are those provided in the Bird Banding Manual and by Wood (1969). However, the Banding Office is working with others (eg. Pyle *et al.* 1987) who have published useful criteria that have not yet been formally accepted. It is intended that the keys put forth by Pyle *et al.* (1987) form the basis of a set of evolving keys for North American passerines.

A bird is aged according to the number of **calendar** years it has survived. Birds in their first year are designated as hatch year (HY) birds until 31 December of that year. Once 1 January of the next calendar year arrives, the bird is considered to be in its second calendar year (SY) even though it may only be six to seven months old. This system of ageing allows the bander to place a bird in any of the following year classes:

(i) U denotes birds of unknown age. The corresponding numeric code is 0.

(ii) HY, SY and TY, respectively, refers to the bird being in its first, second and third calendar year. These age classes are coded numerically as 2, 5 and 7, respectively.

(iii) AHY, ASY and ATY, respectively, denotes birds that are **at least** one, two or three calendar years old. For example, AHY stands for "after hatch year"; the bird is **at least** one calendar year old. A bird hatched in May will be AHY in January, but it is still only about 8 months old. AHY is simply a catch-all code to designate birds that are at least SY, but for which the age could not be more precisely determined. These age classes are coded numerically as follows: AHY = 1; ASY = 6; and ATY = 8.

The following alpha and numeric codes are used to indicate sex: M (or 4) = male, F (or 5) = female, and U (or 0) = unknown sex.

Dichotomous keys like those found in the Bird Banding Manual are usually the easiest to use. Merely start at the top of the page and work your way through the series of couplets until you arrive at the right age and sex "answers." The answer is often an age choice, separated by a backslash (e.g. HY/SY). The slash merely represents the new calendar year. Choose the correct code depending on whether the season is post-breeding (e.g. fall HY) or after the new year and prior to breeding (e.g. spring SY). Hence, a bird of the year that is banded on 31 December might be aged correctly as HY. However, if it is retrapped on 1 January, then it automatically becomes SY (i.e. it is in its second calendar year). Likewise, a bird that is aged as U in December automatically becomes AHY in January. In effect, all birds have a "birthday" on 1 January!

Often, it is impossible to correctly age a bird unless you know its sex. Just as often, you'll need to know its age before you can sex it. It sounds a little confusing, but it's a matter of applying what you know in a logical sequence.

Be aware of the difference between "useful" characteristics (e.g. feather shape) and "reliable" ones (e.g. degree of ossification). A general rule of thumb is that reliable characteristics receive greatest priority; useful characteristics are used primarily as additional clues.

If you're not 100% certain of the bird's age or sex, **don't guess!** Guesswork destroys the reliability of your data, making it useless. It's much better to simply call it "unknown" and move on to the next bird. If you have a good hunch though, record it in the remarks section of your banding sheet. Subsequent recaptures may verify or refute your hunch and in either case you'll have learned something.

Many physiological processes cause age-dependant changes in birds and are primarily used as age indicators, while other processes, such as the development of cloacal protuberances in males during the breeding season, can be used as sex indicators. Measured characteristics are most often used to indicate sex. With the exception of raptors and most shorebirds, males are generally larger than females. As a general rule, graded characters (e.g. "less dark", "more pointed") should not be used alone as criteria for age/sex.

The following sections provide an overview of age and sex-related physiological processes and useful measuring techniques. For a thorough treatment of the subject, see Pyle *et al.* (1987).

10.10.1. Physiological Processes

(i) Skulling

Just as in human babies, which have a soft-spot on their heads for several months after birth, the skulls of young birds also take several months to develop. Although not widely used in Europe, skulling is a standard ageing technique for North American passerines. It is a great technique, but it does take a lot of practice before it is mastered. An experienced person should check your age determination for each bird until you are completely trained.

The juvenile skull is composed of a single layer of bone. As the bird matures, a second layer of bone forms underneath the first, and thin columns of bone form perpendicularly between the two layers. The entire process of skull pneumatization, or ossification, usually takes several months, but this is extremely variable. For example, many warblers have fully formed skulls in about 4-6 months, whereas thrushes may still have incompletely ossified skulls in their second year, and even beyond.

To look at the skull, part the feathers of the crown (Figure 25), using a bit of water on your fingers to keep the feathers patted down. Do not use any other wetting agents, including saliva. Push the feathers aside to leave a clear patch of skin. In thick-skinned birds, it is often easier to see their skulls if you part the feathers on the back of the neck (the skin of which is thin and transparent) and moving the skin up to the crown of the head. Many people find it easiest to examine the skull through a magnifying glass mounted on a stand placed beneath a strong light, but daylight on its own works well if you have excellent eye-sight. You may have to arrange your lighting or angle the bird so that the light does not produce a glare on the skull. Now, look **through** the skin (which is usually thin and reasonably transparent) to determine the extent of ossification.

What are you looking for? On one extreme, the skulls of juvenile birds appear uniformly pinkish in colour. Somewhat older birds will show contrast between the whitish solid bone starting to form at the back and sides of the head and the pinkish "windows" of unossified material. Fully ossified skulls appear uniformly whitish. Look hard through the skin and you'll see tiny stipples or dots in fully ossified regions of the skull.

Surprisingly enough, the two extremes can be the most difficult to separate. At intermediate stages of pneumatization, however, contrast between unossified and ossified areas is (after some practice) readily apparent. It is useful to record the extent of ossification on your banding sheets. Figure 26 illustrates an example of a skull classification system. After the bird has been skulled, don't forget to smooth its crown feathers back down before release.

Skulling is routinely done from mid June to 31 December (providing that the temperature is above freezing), but check the various references to see how late in fall that skulling is reliable as it varies between species. Birds with completely ossified skulls cannot be reliably aged after certain dates and they should go down as "U." However, the skulling practice must continue beyond the skull-completion dates, since there will still be many birds with incompletely ossified skulls which can be reliably aged as HY. Also, some species (e.g. thrushes and swallows) can often be reliably aged as SY by skulling into the spring, especially when used in combination with other features.

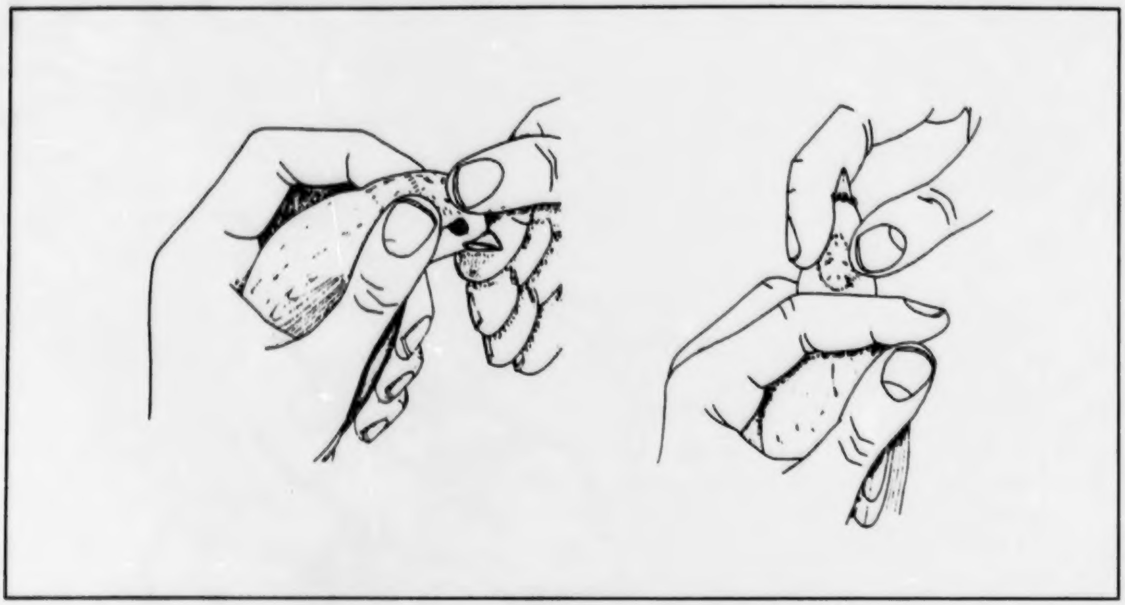


Figure 25. Two ways to hold a bird for skulling (from Pyle *et al.* 1987).

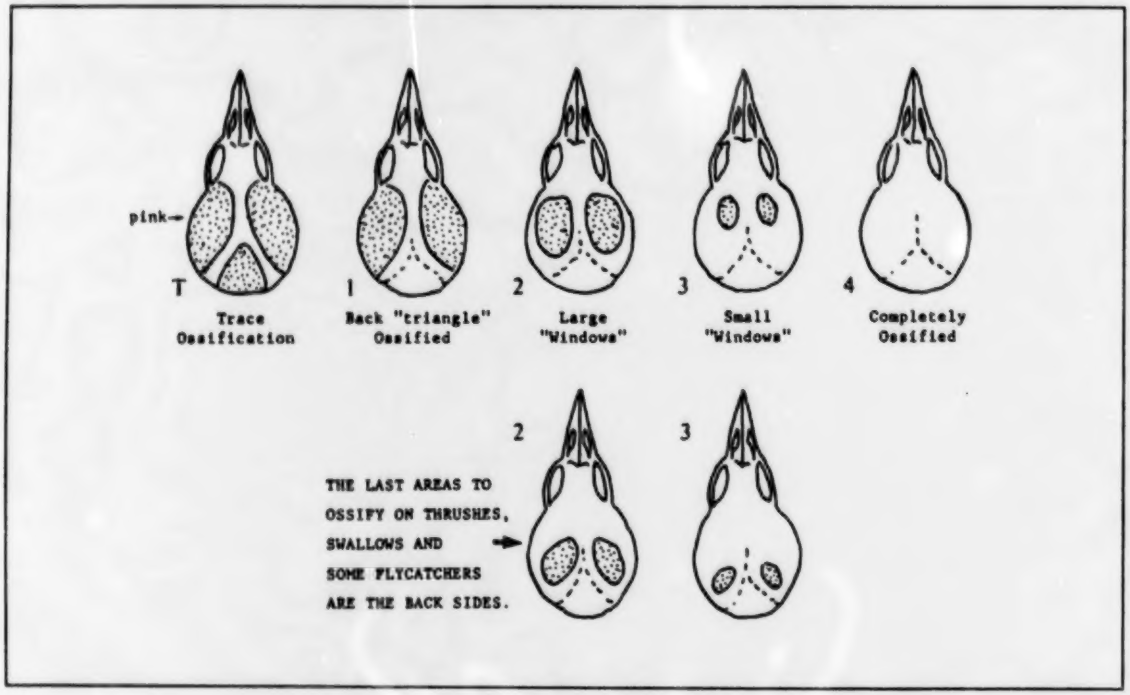

pink
T
Trace Ossification
1
Back "triangle" Ossified
2
Large "Windows"
3
Small "Windows"
4
Completely Ossified
2
3
THE LAST AREAS TO OSSIFY ON THRUSHES, SWALLOWS AND SOME FLYCATCHERS ARE THE BACK SIDES.

Figure 26. One system of assigning ossification classes.

(ii) Moult

Feather condition can tell you a lot about a bird's age, provided that you've got a basic understanding of the bird's moult strategy. Once old feathers fall out and new feathers have grown in, their smoothness, colour and sheen begin to change. Abrasion, wind friction, and preening all wear away the tips of feathers. This is most noticeable in flight feathers ("remiges" = primaries, secondaries and tertials) and tail feathers ("rectrices") that are old. When you are looking for contrast in wear of the feathers, look for the tiny notches and frayed edges of older feathers. Between moults, the sun causes the colour and sheen of feathers to fade and change in quality. This is evident in many brightly coloured birds such as Northern Cardinals and Blue Jays, but in "little brown jobs" the alteration is often only noticeable when it contrasts with recently replaced feathers. **Contrast** between new and old feathers is the important feature.

Birds cope with this constant degeneration of their plumage by moulting. Moult is generally confined to two times of the year; the prealternate (prenuptial) moult occurs just before the breeding season when the bird moults into its alternate breeding plumage. The prebasic (postnuptial) moult occurs after the breeding season, though non-breeders may moult during the breeding season. All North American passerines have a prebasic moult, but only about half have a prealternate moult. Species which don't have a prealternate moult acquire alternate plumage through wearing away the tips of body feathers.

Depending on the species, the prebasic moult occurs sometime between May and December, but usually between July and September. At this time, the adults of most passerine species have a complete moult, meaning that all flight and body feathers are replaced. Hence, for many species, a bird captured in mid summer that is undergoing a complete moult is almost certainly an adult. On the other hand, the juveniles of most species have an incomplete moult in which replaced feathers include only body feathers, lesser and middle coverts and none, some or all of the greater coverts. They do not moult their flight feathers or tail feathers. Young birds can be aged by the degree of contrast present between the juvenal feathers and the more recently replaced adult type feathers.

(iii) Feather Characteristics, Shape and Wear

Although feather shape and wear are useful features to look at when ageing birds, the differences between adult and HY/SY feathers are apt to be subtle. Hence, as an ageing technique, feather characteristics are often most appropriately applied in conjunction with other ageing techniques.

Juvenile primaries and tail feathers tend to be thinner, more tapered and less durable than adult feathers, and will show pronounced wear more quickly than adult feathers. Also, because juveniles only undergo a partial moult, the old juvenal feathers will often contrast with the recently replaced adult type feathers. Therefore, depending on the time of year and moult sequence of the species, feather shape and wear can be useful age indicators.

The outer second and third rectrices of a juvenile's tail and the longest primary feathers will show the most pronounced difference in shape from those of adults. In juveniles, these feathers are usually slender and tapered, forming a sharp angle where the outer web of the feather declines from the feather tip (Figure 27). Adult feathers are often more truncate and the angle formed by the outer web and the feather tip is less sharp. This feature is most useful for ageing corvids, chickadees, thrushes, warblers, orioles and fringillids, but many individuals will show intermediate rectrix shape. These individuals cannot be reliably aged by feather shape. Indeed, birds should not be aged on the basis of feather shape alone. Not only is there a lot of variation, but even experienced banders have difficulty in consistently assessing this feature.

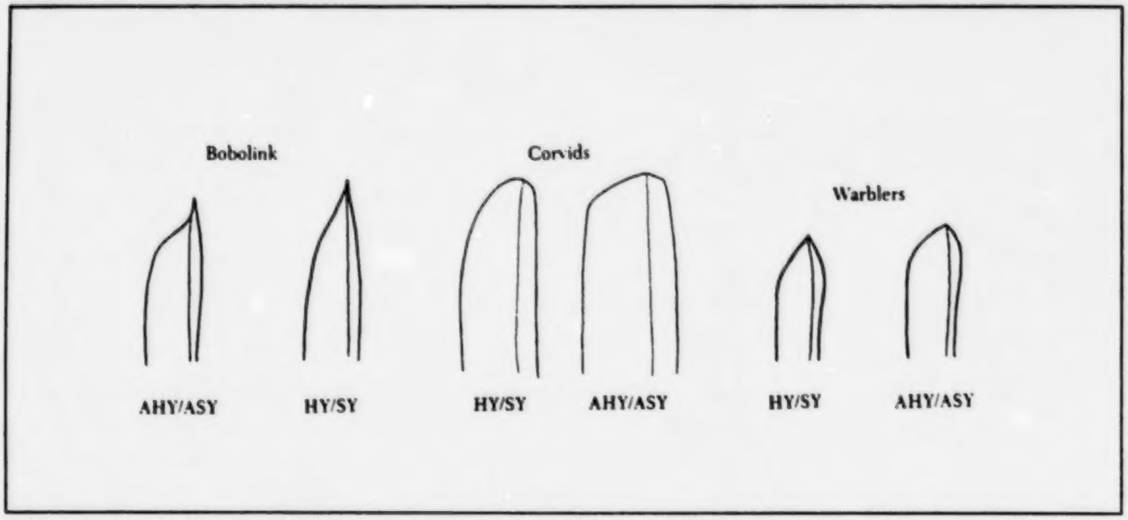


Figure 27. Juvenal and adult tail feather shapes (from Pyle *et al.* 1987)

The use of feather wear to indicate age is most effective immediately after the prebasic moult, when the retained juvenal feathers are two to three months old and contrast with freshly moulted flight feathers. In spring, although the adult feathers will be worn, they should still retain more of their sheen and colour relative to retained juvenile feathers. The central rectrices should be checked first because they receive the most wear, although they are often replaced during the first prebasic moult.

Covert contrast is apt to be one of the most useful ways of ageing Dendroicid warblers because the juvenile primary coverts are usually retained, whereas most or all of the greater coverts are usually replaced. The new greater coverts of the HY/SY bird will have more sheen and a darker colour than the older primary coverts. Adults, by comparison, will have uniform coverts with fresher, paler edges. Around the time of the prealternate moult, however, this characteristic becomes less useful. Both ASY and SY birds of species with a partial prealternate moult could replace the greater coverts again at this time, resulting in contrast between two feather ages in adults and two or possibly three feather ages in SY birds.

Birds need energy for feather growth. When there are inconsistencies in the quality or quantity of the diet, small structural flaws or breaks can appear in the flight feathers and tail feathers. These differences look like faint bars in the feather and are called growth bars. Severe fluctuations in diet quality can cause fault bars which are actual points of weakness where the feather could break. Because juveniles grow in their tail feathers all at the same time, growth and fault bars will lie parallel to one another. In adults replacing their feathers symmetrically two at a time, these bars appear scattered (Figure 28). However, an adult bird could lose its tail and have to regenerate all its feathers at once, and juveniles may moult some of their rectrices and appear to have scattered growth bars. Therefore, growth and fault bars should only be used to support other ageing criteria.

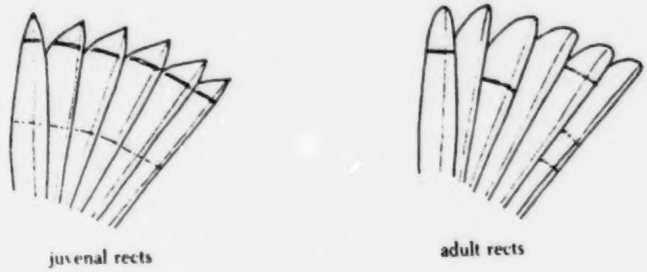


Figure 28. Growth and fault bars in juvenal and adult tail feathers (from Pyle *et al.* 1987).

(iv) Plumage Colour

Plumage colour can vary both with sex and with age. Males are apt to be brighter or shinier than females. Young birds are apt to be more spotted, streaked and duller than adults. Plumage colour is often the most obvious and at times easiest way of ageing or sexing a bird, but banders should be aware that plumages may change with both moults or may not differ at all between ages and sexes in some species.

SY males and ASY females may be easily confused, so beware of birds with intermediate plumage characteristics. Bright, well-marked young birds are likely to be males, and bright females are likely adults. In this way, plumage can be used as an indicator of either sex or age. Unless there is a clear distinction between plumages of different ages or sexes, be careful.

(v) Cloacal Protuberances and Brood Patches

During the breeding season, adult males develop enlarged, swollen cloacal protuberances (Figure 29a). This helps with sperm storage and transfer of sperm to the female. During nesting, females lose the feathers on their belly and develop a brood patch (Figure 29b). This clear patch of skin becomes highly vascularized and a little swollen at the time of egg laying in order to facilitate heat transfer from her body to the eggs. Be careful that you don't mistake the smooth bare belly of a juvenile with an adult female's brood patch; the latter is wrinkled.

Birds with a cloacal protuberance can definitely be sexed as males. Birds with a well-defined brood patch can be reliably sexed as females in almost all passerines (not useful for grebes, most shorebirds, most rails, and all pigeons, cuckoos, and woodpeckers). However, birds with a partial brood patch or without a cloacal protuberance cannot be reliably sexed as females. For example, non-breeding males may not develop a cloacal protuberance, while some males may help incubate the eggs and develop a partial brood patch. Non-breeding females may or may not develop a brood patch. Naturally, female cowbirds never develop a brood patch. Hence, no bird can be sexed based upon the **absence** of a brood patch or cloacal protuberance.

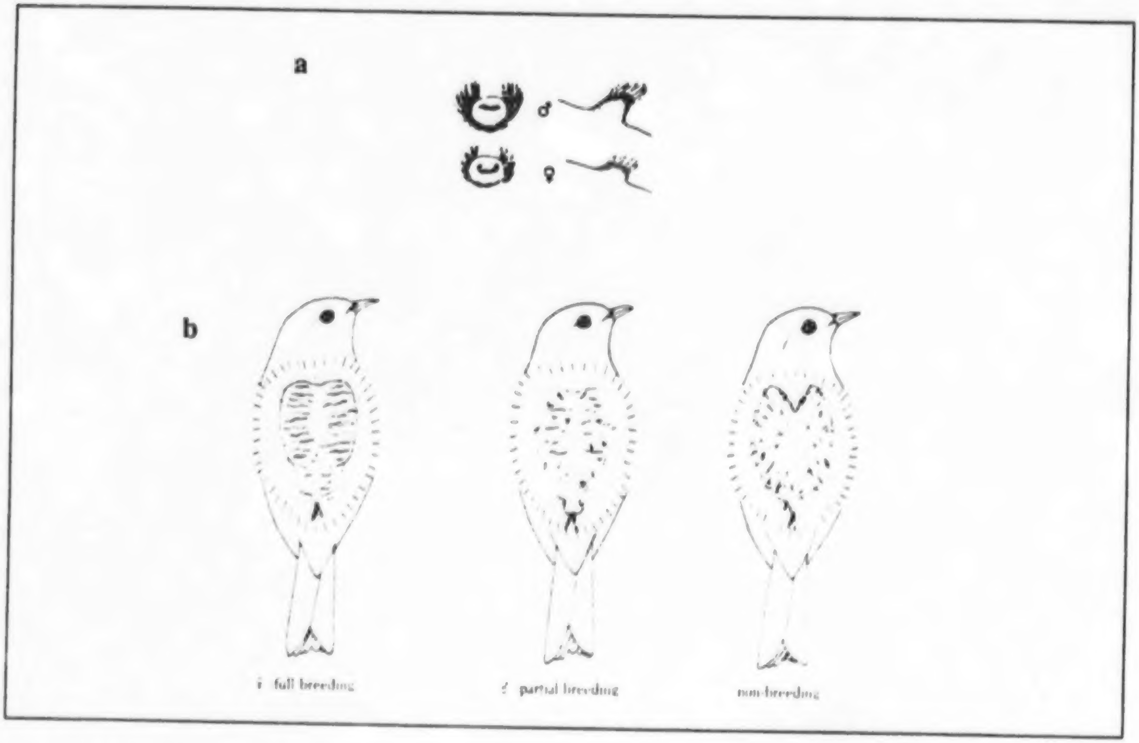


Figure 29. a) Male and female cloacae as they appear during the breeding season, showing larger protuberance in the male, together with a slit-shaped opening in the male versus a C-shaped opening in the female, and heavier feathering in the male (from Svennson 1992); b) brood patches in different stages of development (from Pyle *et al.* 1987).

(vi) Features of Juveniles

There are no really good standard references for identification of juvenile birds. Nevertheless, juveniles are usually fairly easy to distinguish from adults. Feather structure of juveniles is slightly looser and less dense than that of adults (especially on the belly and undertail coverts) and the plumage is often more streaked or spotted. Juveniles will often have wing bars or lack eye rings, contrary to adult characteristics.

Juveniles will retain some of their nestling characteristics for a while after fledging. For example, the feathers of the leg and belly develop slowly in juveniles and these areas may remain bare for some time after fledging. Again, don't confuse a juvenile's smooth bare belly with a brood patch! The gape remains swollen and more brightly coloured for a time in juveniles and the inner mouth lining, bill and iris can remain a lighter colour even until after the prealternate moult. The legs are swollen and fleshy in fledglings and the bill, tail and primary feathers can take almost a month after fledging to reach full size. Look for remains of feather sheaths at the base of flight feathers and tail feathers.

In summer, the flight feathers and tail feathers of juveniles will appear much fresher than those of adults which have been wearing their alternate plumage for some time. Skull ossification will be just beginning.

Juveniles cannot usually be reliably sexed. In a few species, sexual differences occur in flight feather coloration, bill colour or wing length. Keep in mind that juvenile flight feathers may not be fully formed and therefore will be on the lower end of the wing length range cited for each sex.

10.11. Useful Measurements ("Biometrics")

(i) Wing Length

Wing length is important to measure since it can help you identify the species, is a useful standardization feature when analyzing bird body weights, and can help separate the sexes in some species.

When used for sex determination, there is usually a certain amount of overlap in the wing lengths of males and females. For example, if you plotted the distribution of the heights of North American human males and females on a graph, you would find that two curves are generated — one for each sex — but that the two curves have a broad zone of overlap. Males tend to be larger than females, though some females can be very large while some males can be very small. (If you ignore the zone of overlap, a "bimodal" curve is apparent; a bimodal curve indicates that there is a sexual difference). Based upon the shape and placement of the curves, you can calculate the statistical probability that a human of a certain height is a male or a female. In bird banding, we like to ensure that our age/sex determinations are right 95% of the time. That's why birds of "intermediate" wing length are recorded as "unknown" sex.

There are two common ways to measure wing length. The wing chord or **unflattened** wing length (Figure 30) is used most often in North America to measure the natural, unflattened arc (the "chord") of the wing. To take this measurement, hold the bird in the bander's grip and lift the thumb away from the side of the bird's body. The wing will then be accessible for measuring. Use a ruler with a perpendicular metal stop set at zero, and slip it under the wing. Slide the stop of the ruler until it fits snugly against the bend in the wing, with the primaries parallel to and extending down the ruler. The wing chord is read to the nearest millimetre. If you tilt the ruler to a 45° angle to the plane of the wing, so much the better, since this keeps the feathers off the ruler and reduces friction and increases accuracy. The wing should be as close to a natural resting position as possible, ensuring that all primaries lay in their natural alignments. Make sure the ruler stop is firmly pressed against the bend of the wing, but don't pull the wing out of position.

The **flattened** wing length (Figure 30) is used most often with museum specimens and is taken in the same manner as above, but the wing is pressed flat against the ruler with the thumb on the wing coverts. This measurement is usually about 0.5 - 2% longer than the wing chord. The flattened wing is sometimes touted as the most accurate and consistent measurement of the two techniques, but this is not necessarily so. In any case, it is generally not used or cited in North America except for shorebirds.

When measuring wing length, watch out for the presence of any heavily worn, broken, missing or growing primaries which will lead to a false measurement. It is best not measure wing length in such cases, since the data will not be representative.

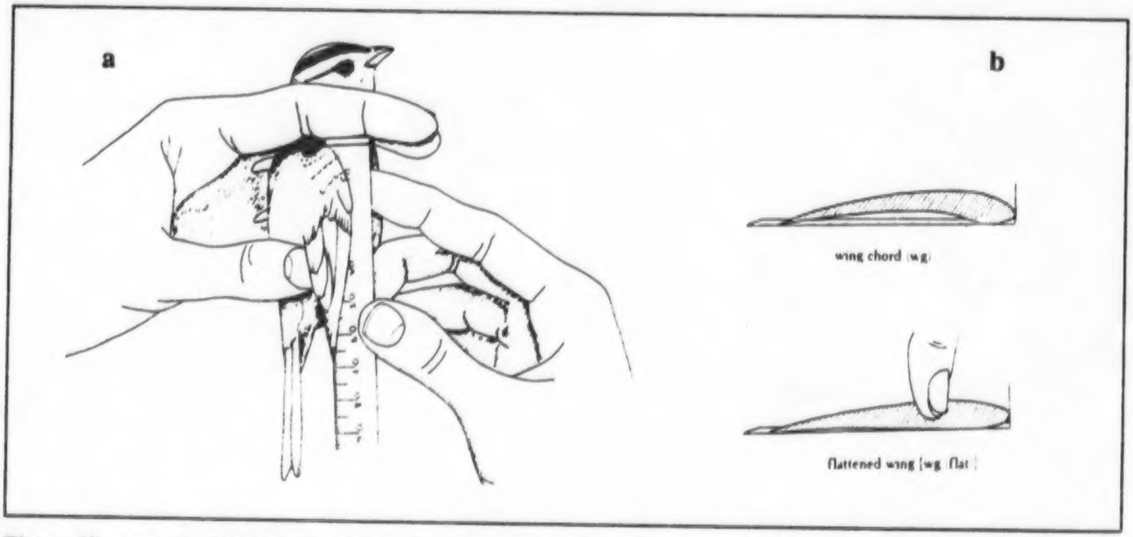


Figure 30. a) A good hold to use for measuring wing chord; b) profiles of wing measurement techniques (from Pyle *et al.* 1987).

(ii) Wing Formula

The "wing formula" is composed of several things, including: (1) the length and position of each primary in relation to one another, (2) the occurrence, position and length of notches on the inner edge of each primary, and (3) the occurrence, position and length of emarginations (narrowings in the vane) on the outer edge of each primary. The specifics of wing formulae for various species are extremely useful as tools for the identification and separation of similar species (e.g. *Empidonax* flycatchers). Not much is known about the wing formulae of North American birds and further study would be valuable, especially in relation to ageing and sexing by the length of the 10th primary or by the length of emarginations in the outer primaries.

When measuring distances between individual primaries, or primaries and secondaries, or primaries and the primary coverts, the wing should be in its natural closed position. A transparent ruler or callipers can be used to make the measurements. Each measurement should be made from the tip of the longest primary to the other feathers and distances subtracted if, for example you wanted to know the distance between the 5th and 6th primaries (Figure 31). This difference is represented in writing as p6-p5. As with the measurement of wing chord, make sure that there are no breaks in the feather or that the bird is not in active moult. Emarginations are measured from the tip of the feather to the start of the wider part of the feather.

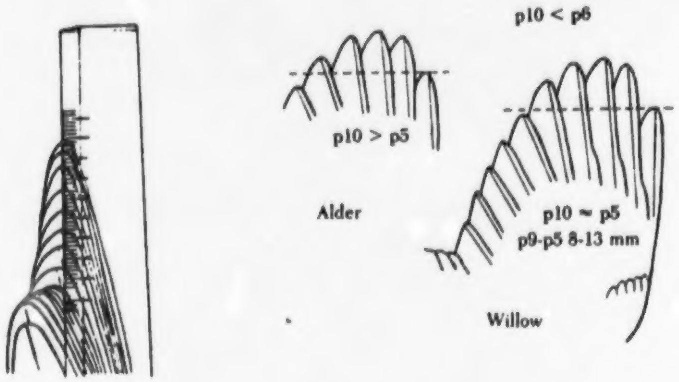


Figure 31. How to take wing formulae (from Pyle *et al.* 1987 and Svennson 1992).

(iii) Tail Length

Tail length is sometimes used to determine sex (e.g. Barn Swallow) and for species identification. It is defined as the distance between the tip of the longest rectrix and the point at which the two central rectrices protrude from the skin. Use a ruler that has the zero mark set right flush to one end. Insert the ruler between the two central rectrices, holding the ruler in line with the tail. Push the end of the ruler firmly against the feather root; that is, the point of insertion of the feathers (Figure 32). As with wing length, feather wear will result in a measurement of tail length that could be up to 10% shorter than normal. Watch out for breaks in the feathers and signs of active moult that could lead to a false reading.

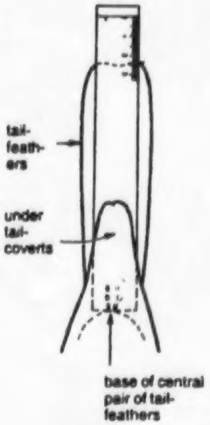


Figure 32. Measuring tail length (from Svennson 1992).

(iv) Body Weight

Birds are normally weighed as the last step of the banding procedure, with the band on. Body weight is most quickly and accurately measured with the bird confined in some sort of weighing cup or cone on an electronic balance, but Pesola scales or triple-beam balances are also adequate.

Body weight is extremely variable, depending on time of day, food availability, and whether the bird is migrating, breeding, moulting or loafing. Although this measurement is not very useful for ageing, sexing or identifying a species of bird, it is an excellent quantifiable indicator of the bird's condition. It can be used separately or in conjunction with how much fat is present on the bird. Note that females carrying eggs will weigh considerably more than normal.

(v) Fat and Crop Content

Birds store fat and use it as a readily accessible source of energy, especially during migration. During migration, birds that have little or no fat have probably just arrived and will need to spend a day or two to replenish their stores. Birds with large amounts of fat are probably ready to depart on the next phase of their journey. Fat content is also a good general indicator of the condition of the bird and is useful for gauging the condition of sick or injured birds.

Birds store fat in the furculum (the hollow where the neck joins the body), lower abdomen, and sides of the body underneath the wings (Figure 33). These are their fuel tanks. After banding, blow on the body feathers, parting them along their natural tracts. You can easily see the fat deposits lying beneath the skin. They show up as yellowish or orangeish masses, contrasting with the red muscular areas. With a little practice and getting a sense for how deep an empty furculum is, you can gauge the relative amount of fat on a bird's body. One conventional method that is used to score fat is shown in Figure 33. There is a lot of variation in assignment of fat scores, so if your study depends on consistent scores, have one person do all the work or ensure that everyone is trained to the same criteria.

The crop content of raptors is assessed by placing a finger on the furculum. A large lump means that the bird has just eaten and the crop is full. With experience, you can easily distinguish between an empty, half-full and full crop.

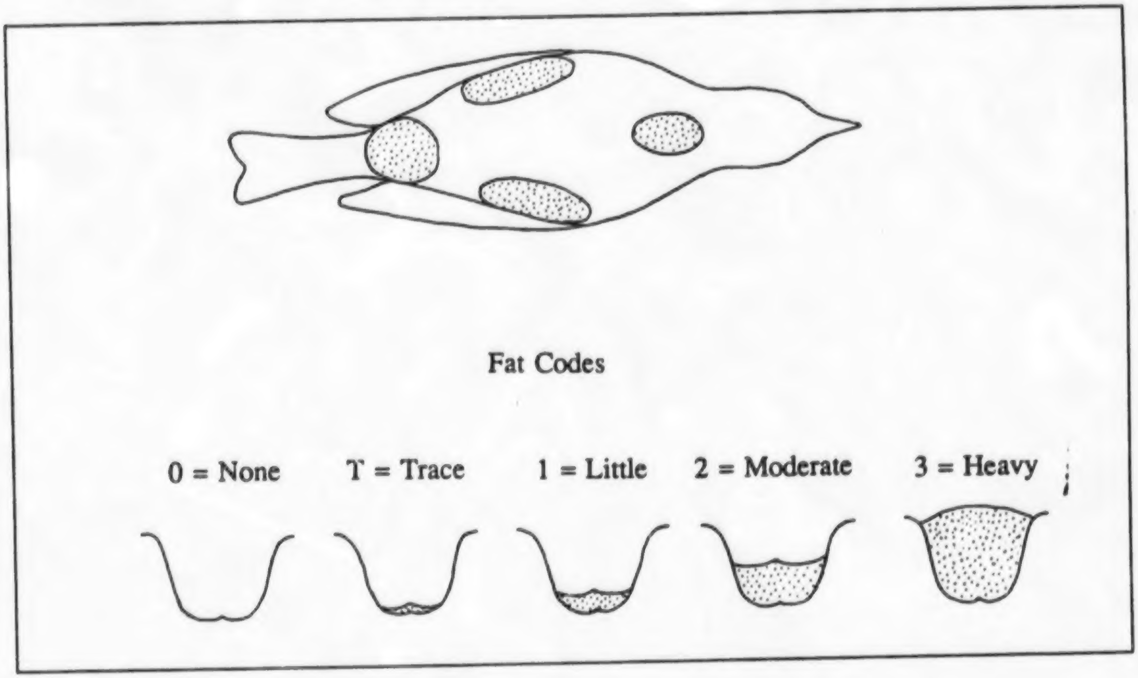


Figure 33. Where to look for fat and one method of coding its extent in the furculum (neck hollow).

(vi) Bill Length, Width and Depth

Two common methods of measuring bill length require the use of callipers. The culmen refers to the distance between the anterior end of the nostril and the tip of the bill (Figure 34a). The exposed culmen refers to the distance between the tip of the bill and the edge of the feathering at the base of the bill (Figure 34b). The culmen may be less accurate than the exposed culmen due to variation in the length of the nostril, but it is likely to be the easiest and most consistent method of measurement.

Bill width and depth are also taken at the anterior end of the nostril. For measuring bill depth, the calliper jaws should be oriented perpendicularly to the axis of the bill (Figure 34c). To measure bill width, open the calliper jaws so that they stop at the anterior end of the nostrils when they are moved toward the base of the bill (Figure 34d). Make sure that you know how to properly read the measurements displayed on the scale of the callipers. Note also that stiff callipers can crush. Get a good tool, or use a set of dividers to get the span and transfer the measurement to a ruler.

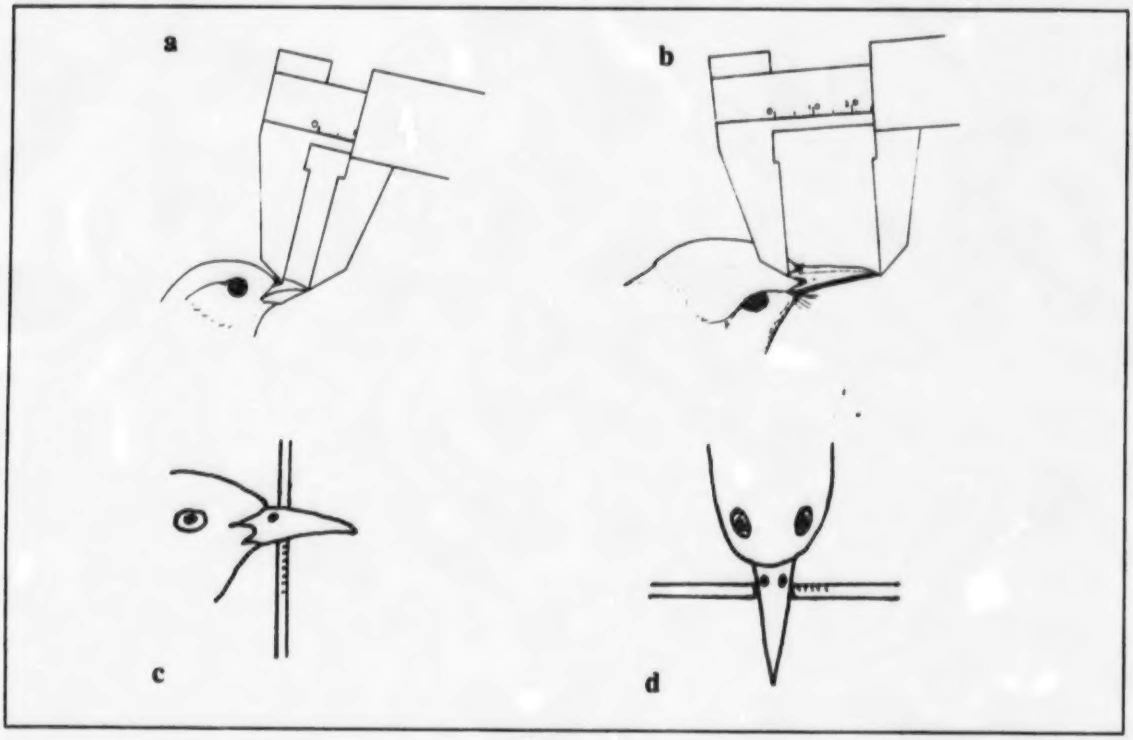


Figure 34. a) Measuring culmen and b) exposed culmen (from Pyle *et al.* 1987); c) measuring bill depth and width at the anterior edge of the nostril.

(vii) Tarsus and Foot Length

With callipers, tarsus length is measured as the distance between the depression in the intertarsal joint and the distal end of the last leg scale before the toes diverge (Figure 35a). Variations in tarsus length between similar species and sexes is usually small, so this measurement is not often taken.

Foot length is useful for sexing some owls. It is the distance between the edge of the pad of the halyx (hind toe) and the edge of the pad of the longest front toe (Figure 35b). This measurement is most accurate when made with callipers. Beware of the talons!

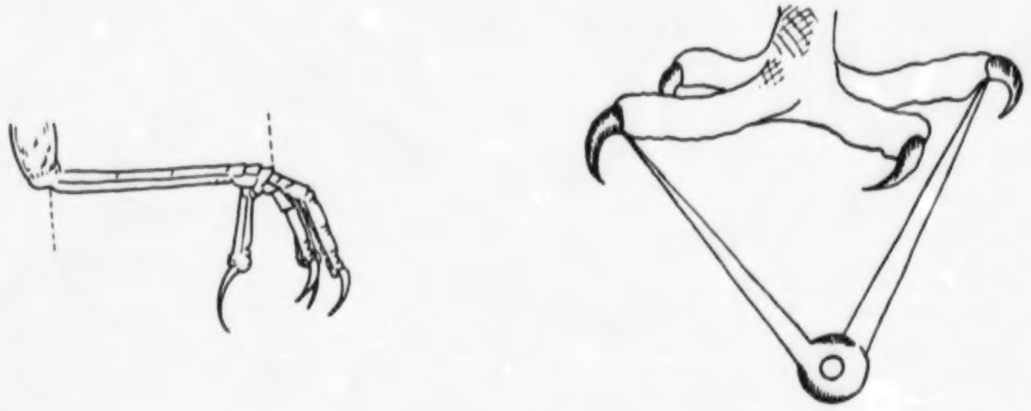


Figure 35. Measuring tarsus length (from Pyle *et al.* 1987) and the length of an owl's foot pad.

(viii) Crown Patch

Some warblers have crown patches, the length of which is useful for sexing. Using callipers, measure the distance between the anterior and posterior edges of the crown patch, along the medial axis. The feathers must be lying flat in their natural position, so this measurement should be made before skulling.

10.12. Parasites

All animals carry parasites, and every bird has them. Comparatively little is known about bird parasites. Depending on available time and personal interest, parasites can be collected to study how the parasites on a bird change with its age, the seasonal infestation rate, which species are involved and the geographical distribution of vectors. Interested banders should contact university entomologists to get information on the kinds of data needed for collection and specimen preparation methods. Most ectoparasites can be easily taken off live birds, while blood samples are taken to collect blood parasites. Endoparasites can be obtained from very recently dead birds. Ectoparasites can be stored in 70% alcohol.

Encounters with parasites should be anticipated when working with birds. This is particularly important when reaching into nests above your head to retrieve nestlings for banding. Blow fly larvae can be the most obvious and disgusting of these parasites, but flat flies, lice and mites are also common. Most bird parasites are harmless to humans.

Flat flies (Hippoboscidae) are able to slip in and out among body feathers. They generally only fly when the bird is handled and its feathers are ruffled. They give birth to live young. The larva is deposited on the feathers of the bird, drops to the soil where it pupates into an adult and attempts to find a host. When flying from host to host, flat flies can carry feather lice and mites and act as dispersal agents.

Feather lice (Mallophaga) are small, soft-bodied, wingless insects which have specially developed claws for hanging on to feathers and skin. They feed on feather scales, blood and lymph. Entomologists suspect that these organisms carry infectious agents for birds. Healthy birds can usually cope with a few lice by preening, whereas sick or weak birds often seem to be infested with them.

Soft-bodied, wingless, blood-sucking lice (Anoplura) can also be found on birds. Their heads are pointed or tapered rather than rounded as in the Mallophaga and are known vectors of *Typus reckettsiae* of mammals and birds.

Blow fly (Diptera) larvae will attach themselves to any part of a nestling including the inside of the nostrils and ears. The larvae hang on the birds until they have taken enough blood to become a sufficient size, then they drop off and pupate. Their populations cycle, so that when the flies are at their population peak, an individual nestling can literally be covered with them and die from loss of blood.

The most common mites and ticks (Acarina) found on birds are very tiny feather mites that live (presumably harmlessly) among the feather bracts and feed on feather scales and detritus. Ticks are larger than mites. They are eight-legged as adults, and six-legged as nymphs. As adults, they must take a blood meal before dropping off their host and laying eggs in the soil. They are vectors of tick typhus and Lyme Disease.

There are many types of blood parasites. Sampling blood is a delicate process which must be carefully demonstrated and taught to a beginner. Blood sampling also needs to be reviewed by an Animal Care Committee and requires special authorization from the Banding Office. Methods for taking, storing and transporting blood samples and smears are detailed in McClure (1984), but prior arrangements should be made for collaborations with researchers who can analyze and study the samples. The red blood cells of birds contain genetic material; a small sample of blood is invaluable for studies of avian genetics.

10.13. Deformities

Birds are sometimes encountered which have crossed bills, deformed legs, feet or eyes, bald patches of skin, pox and other afflictions. These may be due to disease, the bird's genetics, or toxic chemicals. Not much is known about deformities, or how well a bird can cope with various afflictions. Banders should record deformities on their banding sheets and report any significant findings.

11. RECORD KEEPING

The primary reason for banding is to collect useful, reliable data, and to store these data in a manner that makes them readily accessible for analysis. Success of the banding and recovery reporting system depends on international cooperation among the Banding Offices, all banders, researchers and the public. Prompt submission of data to the Banding Offices allows the Office to immediately respond to people who submit encounter information, and to banders in need of recovery data. All necessary forms for reporting and inquiring about banding data are summarized below and are available from the Banding Office.

Every banding operation must keep careful track of all birds banded and retrapped. In addition, it is recommended that all banders maintain some kind of daily log. Information to be recorded in a log book would include number and type of traps/nets used, hours of operation, weather conditions, names of personnel, a summary of the day's activities, details of any unusual events, and details of any casualties.

Each bird's band number, species, age, sex, banding location, and date trapped must be recorded at the time of banding. Additional information may also be recorded. Many banders routinely record wing chord, weight, fat condition, time trapped, time released and trapping device. Data on plumage abberations, parasites, infections, and descriptions of moult patterns are also often recorded. Banding records must be kept in a comprehensive, orderly fashion. For example, it is much easier for summarizing and reporting data if records of retraps are kept separate from the regular banding records.

In the interests of reliable data collection, every bander must keep field notes (preferably on pre-printed sheets) or enter data directly into the computer program available from the Banding Office. Banding sheets ensure that you will be able to verify your data. In the case of transcription or computer entry errors, data must be traceable to banders and their original field records. Every band must be accounted for, either with data or with an explanation of band loss.

The type and organization of record keeping will depend on the type of banding being undertaken. For example, when banding only one species, a different band series can be used for each age/sex combination. Field notes can then be organized by age/sex category.

11.1. Standard Codes

All codes used in the preparation of banding and recovery data are detailed in the Banding Manual. Every species is given its own common name, species number and alpha-code by the Banding Office. These are the acceptable names and codes for reporting information on a particular species. The four-letter alpha code generally consists of the first two letters of the first part of the common name, followed by the first two letters of the second part of the common name of the species, but exceptions to this rule are common. If you have any doubt, record the full species name on the banding sheet and look up the correct code later. Particularly if you are banding many species, you will find it extremely useful to keep a list of the alpha codes posted in plain view at your banding site. The same list should also give the recommended band sizes for each species.

Banded birds are given a 3-digit status code. The first digit describes the state of the bird at the time of capture. For example, a code of three (3) means that a normal, wild bird was banded. The second two digits are additional information codes. They tell what was done to the bird in addition to placing a standard band on one of its legs. For example, was the bird colour banded (code 01), or did it receive some other supplementary marker (code 06), or was nothing special done (code 00)? Other codes are used to designate age and sex, region of banding, and so on.

11.2. Banding Sheets

Long Point Bird Observatory's (LPBO) banding program focuses on migration monitoring. Among other activities, mist nets and a variety of trap devices are used to catch a great number of birds of many different species. As an example of a complex banding situation, a detailed account of LPBO's method of data collection is presented in this section. Feel free to emulate it or modify it according to your own situation.

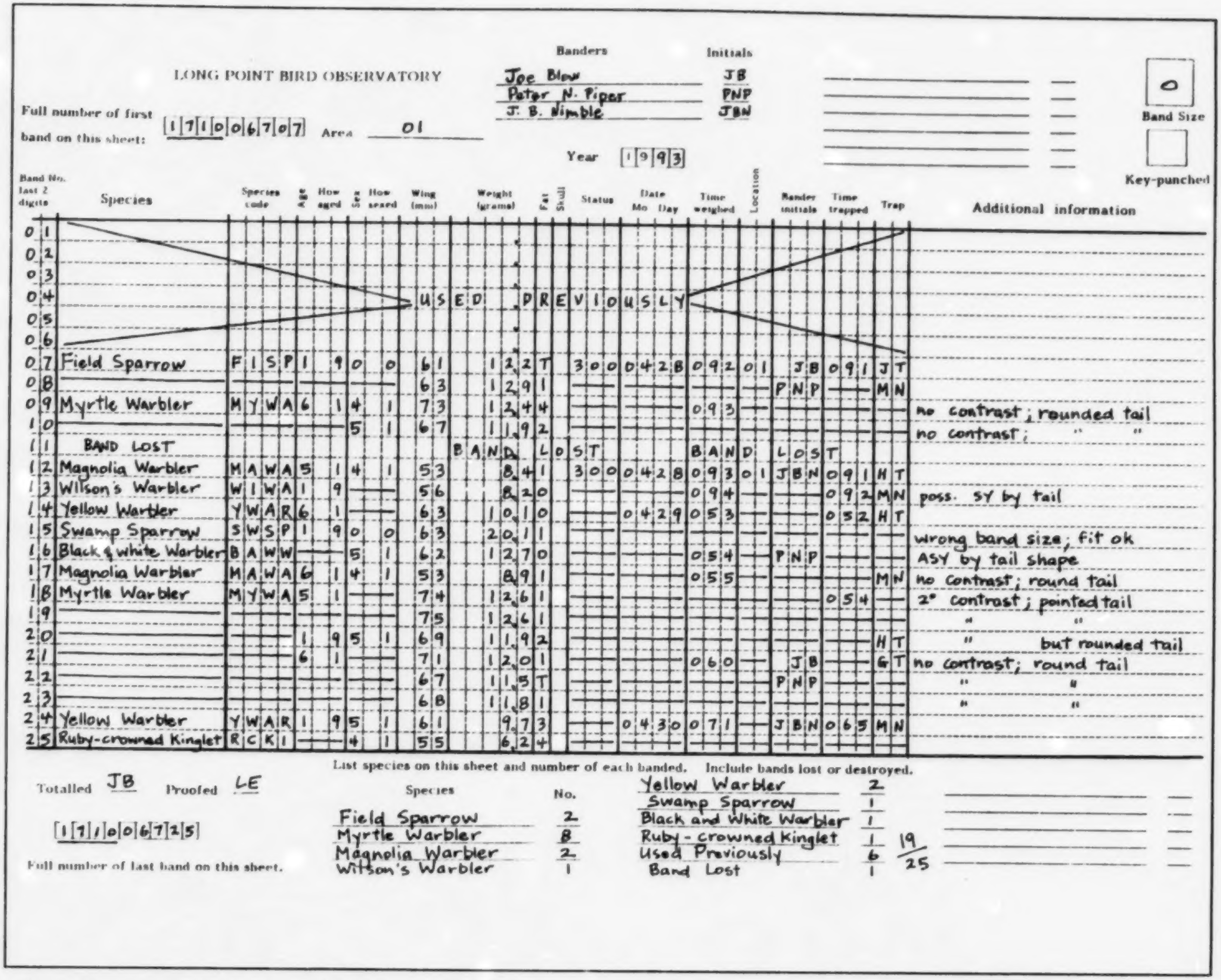
All banding data for each season are kept together in one binder, organized by band size. Data are recorded on the front of each banding sheet (Figure 36). For quick reference, instructions for their completion are handily detailed on the reverse side of the sheet. (These are printed upside down with respect to the front of the sheet, so the binder doesn't have to be turned to read the reverse side).

Apart from the minimal required information (e.g. species name, age, sex, date), LPBO tries to maximize the usefulness of its data set and records several items of additional information. "How aged" and "how sexed" codes help ensure that birds are being aged and sexed according to the proper features, at the appropriate time of year. Wing chord is not only useful for determining species and sex, but it can be used as a standard correction factor for studies involving body weight. Body weight itself can be used in many different studies, as can information on fat and degree of ossification. Trapping time and weighing time are both recorded because birds lose weight during that interval; original body weight can be predicted if the interval is known. Recording time trapped also reminds you of how long birds are being held during a backlog. Body weight also varies according to time of day. The initials of the bander are recorded so any systematic difficulties in data can be traced back to the proper person, and so any recoveries can be ascribed to the original bander. Trap type is recorded since certain studies require banding totals to be corrected for effort, and separate corrections are required for each trap type. Some studies may even require recording which individual trap or net each bird comes from. Finally, "Additional Information" is used for recording brief notes about the bird's age or sex, the presence of any deformities, and "footnotes" that explain any apparent discrepancies regarding such things as band size.

The first and last band number used on each sheet is recorded in the spaces provided. When starting in the middle of a series, begin on the correct line for the first band number and make a note on the sheet that all band numbers prior to the first one used were "Used Previously", lost or destroyed (Figure 36). Only black ball-point pen is used to fill out data sheets. Pencil can smudge or erase, ink from felt tip pens tends to run, and neither pencil nor blue ink reproduces well when photocopied. "Liquid paper" is used to correct mistakes. It is important that all data are legible, particularly if someone else will be key-punching your data into a computer.

On the banding sheet, all data are right-justified in the boxes within their own column. If data are repeated from one line to the next, a horizontal line is drawn below the repeated data. Ditto marks (") are not used to indicate repeated data because they are easily misinterpreted as a number 11. Lost or destroyed bands are recorded as such on the appropriate line for that band number. Any data recorded after a band lost or destroyed must be written in full again, even if it was the same as the previous line containing banding data.

It is imperative that the banding sheets are thoroughly proofed and corrected. This is usually done by the Master Permit holder, but trainees and Subpermit holders can help out too. Complete proofing involves checking to make sure that species codes are correct, and looking for unacceptable age/sex/month combinations, out-of-range measurements, birds banded with the wrong band size, missing footnotes and so on.



LONG POINT BIRD OBSERVATORY

Full number of first band on this sheet: 1 7 1 0 0 6 7 0 7 Area 01

Banders	Initials
Joe Blow	JB
Peter N. Piper	PNP
J. B. Nimble	JBN

Year 1 9 9 3

Band Size 0

Key-punched

Band No. last 2 digits	Species	Species code	Age	How aged	Sex	How sexed	Wing (mm)	Weight (grams)	Fat	Skull	Status	Date Mo Day	Time weighed	Location	Bander initials	Time trapped	Trap	Additional information
01																		
02																		
03																		
04							USED				PREVIOUSLY							
05																		
06																		
07	Field Sparrow	FISP	1	9	0	0	61	12.2	T		300	0428	092	01	JB	091	JT	
08	—	—	—	—	—	—	63	12.9	1		—	—	—	—	PNP	—	MN	
09	Myrtle Warbler	MYWA	6	1	4	1	73	12.4	4		—	—	093	—	—	—	—	no contrast; rounded tail
10	—	—	—	—	5	1	67	11.9	2		—	—	—	—	—	—	—	no contrast; " "
11	BAND LOST							BAND	LOST				BAND		LOST			
12	Magnolia Warbler	MAWA	5	1	4	1	53	8.4	1		300	0428	093	01	JBN	091	HT	
13	Wilson's Warbler	WIWA	1	9	—	—	56	8.2	0		—	—	094	—	—	092	MN	poss. SY by tail
14	Yellow Warbler	YWAR	6	1	—	—	63	10.1	0		—	0429	053	—	—	052	HT	
15	Swamp Sparrow	SWSP	1	9	0	0	63	20.1	1		—	—	—	—	—	—	—	wrong band size; fit ok
16	Black & white Warbler	BAWW	—	—	5	1	62	12.7	0		—	—	054	—	PNP	—	—	ASY by tail shape
17	Magnolia Warbler	MAWA	6	1	4	1	53	8.9	1		—	—	055	—	—	—	MN	no contrast; round tail
18	Myrtle Warbler	MYWA	5	1	—	—	74	12.6	1		—	—	—	—	—	054	—	2° contrast; pointed tail
19	—	—	—	—	—	—	75	12.6	1		—	—	—	—	—	—	—	" "
20	—	—	1	9	5	1	69	11.9	2		—	—	—	—	—	—	HT	" but rounded tail
21	—	—	6	1	—	—	71	12.0	1		—	—	060	—	JB	—	GT	no contrast; round tail
22	—	—	—	—	—	—	67	11.5	T		—	—	—	—	PNP	—	—	" "
23	—	—	—	—	—	—	68	11.8	1		—	—	—	—	—	—	—	" "
24	Yellow Warbler	YWAR	1	9	5	1	61	9.7	3		—	0430	071	—	JBN	065	MN	
25	Ruby-crowned Kinglet	RCKI	—	—	4	1	55	6.2	4		—	—	—	—	—	—	—	

Totalled JB Proofed LE

1 7 1 0 0 6 7 2 5

Full number of last band on this sheet.

List species on this sheet and number of each banded. Include bands lost or destroyed.

Species	No.
Field Sparrow	2
Myrtle Warbler	8
Magnolia Warbler	2
Wilson's Warbler	1
Yellow Warbler	2
Swamp Sparrow	1
Black and White Warbler	1
Ruby-crowned Kinglet	1
Used Previously	6
Band Lost	1

19/25

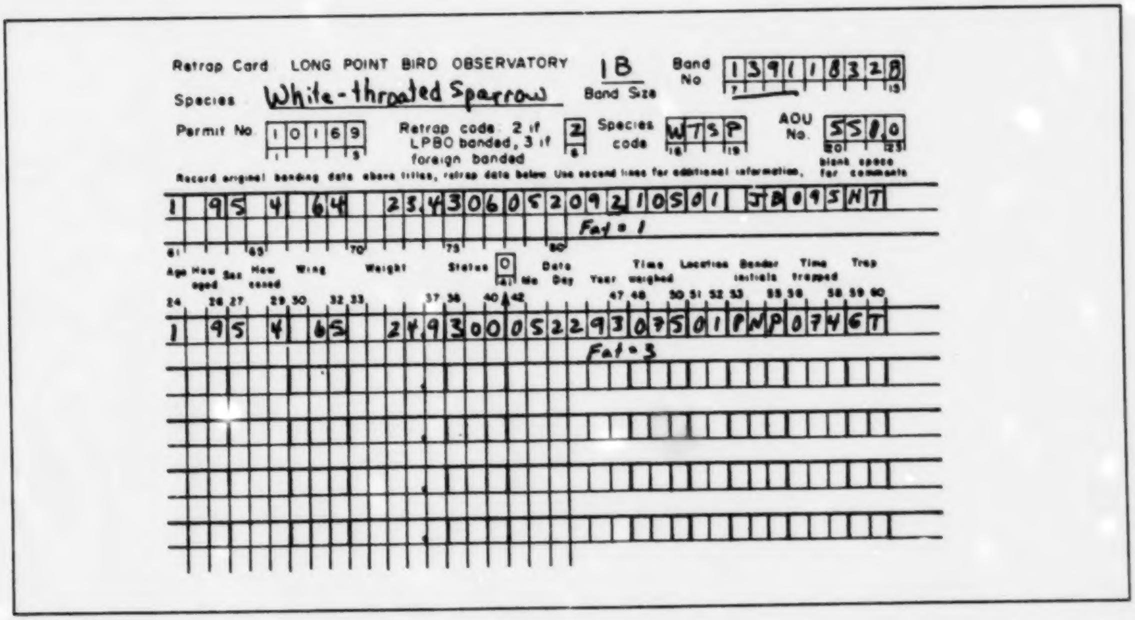
Figure 36. An example of a correctly filled in banding sheet.

11.3. Retrap Cards

Information on retraps can tell you a lot about body weight fluctuations, stop-over periods, site fidelity, annual survival and so on. Retrap data are normally recorded only for birds that have not been handled within the previous 24-hour period. Hence, same-day repeats are simply released unless your study requires a different procedure. LPBO's retrap cards are printed on index cards for durability. They are identical to the banding sheets, except that they have not yet been updated to include data fields for fat condition or skull ossification (Figure 37). These are recorded in a blank space beneath each record line.

Retrap information is entered beginning on the second row; subsequent retrap information is entered on the next lines, all the way around to the back side of the card. If a card is filled, merely start a new card, but staple the two cards together. Look up and transcribe the original banding data to the first row on the card at the end of each day. This allows you to check that measurements and other data are being collected in a consistent fashion and greatly cuts down on the work that must be done at the end of the season. Cards can be filed by band number in a small file box for easy access and then later input on a customized version of the Banding Office's computer data entry program.

Some stations record retraps on a regular banding sheet. Once put onto computer, these records are matched with original banding data. The system can work well if computerization and cross-checking is kept up-to-date, but it is difficult to find records for a particular bird once there are several sheets of data to search through.



Retrap Card LONG POINT BIRD OBSERVATORY 1B Band No 1 3 9 1 1 8 3 2 8 (7–13)

Species White-throated Sparrow Band Size

Permit No 1 0 1 6 9 (1–5) Retrap code 2 if LPBO banded, 3 if foreign banded 2 (6) Species code W T S P (16–19) AOU No. 5 5 8 0 (20–23)

Record original banding data above titles, retrap data below. Use second lines for additional information, blank space for comments

1 95 4 64 23.4 3 0 6 0 5 2 0 9 2 1 0 5 0 1 J B 0 9 5 N T

Fat = 1

61 65 70 75 80

Age How aged Sex How sexed Wing Weight Status 0 (41) Date Mo Day Year Time weighed Location Bander initials Time trapped Trap

24 26 27 29 30 32 33 37 38 40 42 47 48 50 51 52 53 55 56 58 59 60

1 95 4 65 24.9 3 0 0 0 5 2 2 9 3 0 7 5 0 1 P W P 0 7 4 6 T

Fat = 3

Figure 37. An example of a correctly filled in retrap card.

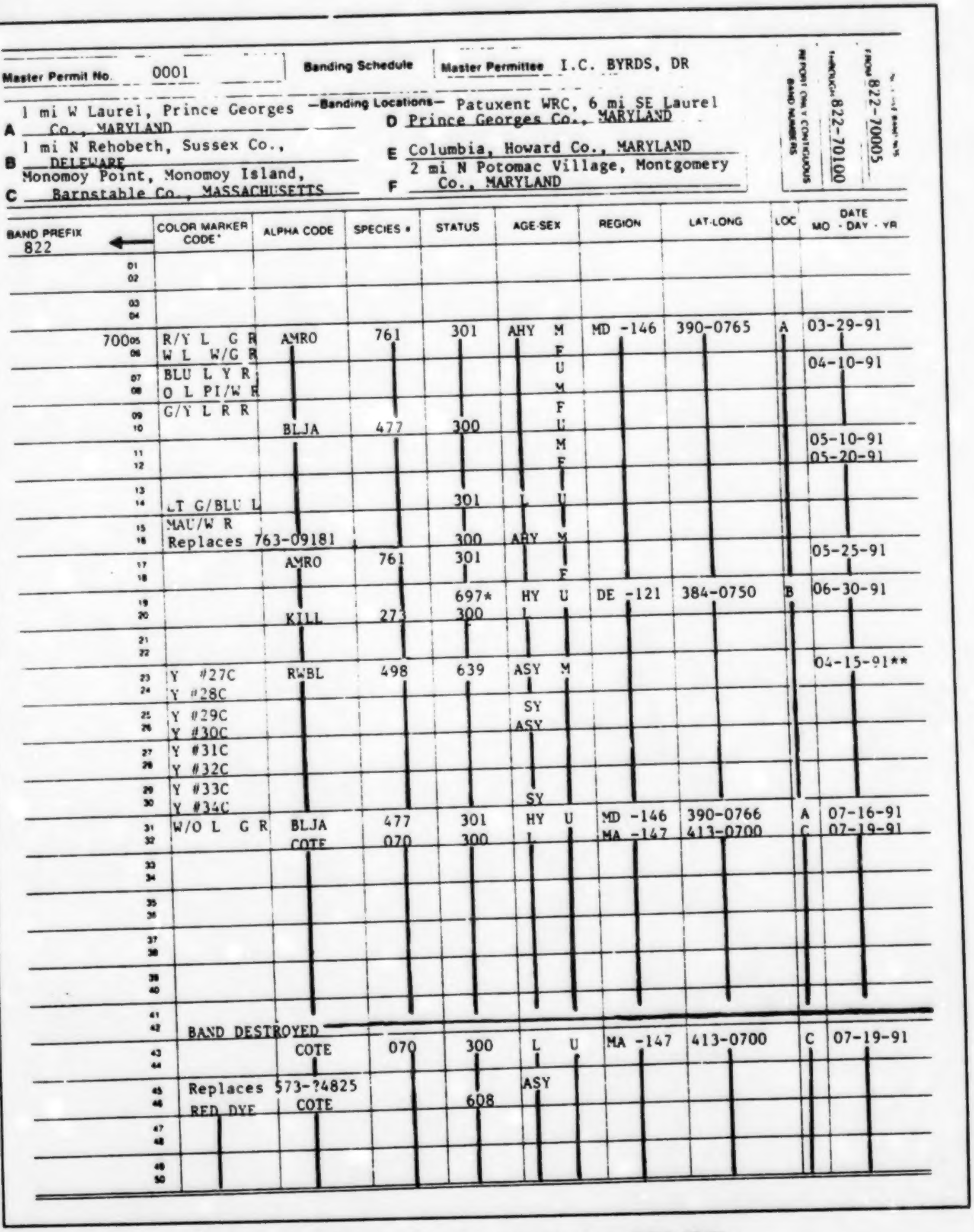
11.4. Banding Schedules

Banding data are summarized and submitted to the Banding Office on forms called Banding Schedules (Figure 38). There is an important difference between a bander's own field records and the Banding Schedules. The Banding Office has a computer program designed to produce Banding Schedules on IBM-compatible personal computers. Data can be entered into the computer at the time of banding or later from hand-written field sheets. Computerized schedules facilitate your data analyses, provide database management capabilities, and save the Banding Office from key-punching the data, reducing the possibility of transcription errors. Until recently, typed or hand-written schedules were acceptable. However, submission of computerized banding schedules is now a requirement. The computer software is provided by the Banding Office.

Detailed step-by-step instructions for the completion of Banding Schedules are given in the Banding Manual and with the data entry program. Some general instructions are well worth repeating here. All schedules must be complete and legibly printed on good quality paper. If data are missing or unclear, the schedule will be sent back to the bander. Pertinent data which must be given for each band number include: the band number, colour marker code, species alpha code, species number, status of the bird, age, sex, region of banding, latitude, banding location, and the date of banding (Figure 38).

Band numbers are reported consecutively, starting on the correct line for the first band number reported on that schedule (eg. band number 1210-88807 is reported on the seventh line of the schedule). Only bands from one series may be reported on a schedule. Permit number, name of the Master Permittee, band numbers reported and banding location must be specified on the schedule. You are strongly advised to keep photocopies of all Banding Schedules submitted, as well as backup computer files.

You must proof your field data before transcribing them onto the Banding Schedules. Proof the schedules again to detect key punching errors before the schedules are submitted to the Banding Office. The computer data entry program incorporates several built-in editing subprograms to help you out, once the manual checking has been done. For example, while entering data the computer may beep a warning at you when you try to enter something that is unacceptable. Once the data have been entered, a sorting and sequence checking routine are run to ensure that all bands are accounted for and that bands and dates appear in their proper sequence. If any errors are found at this stage, then you must cross-check them against the original banding information and make the necessary corrections. Once this is done, it is a good idea to run the data listing program to print out the entire data set. This is then proofed against the original banding sheets to ensure that there have been no key-punching errors. After these are corrected, the data file is then run through an editing program that will flag any suspicious data and warn you of any significant errors that must be corrected prior to schedule generation. As a final check, the schedule generating program runs a final edit to make sure you've corrected the significant warnings. If no significant errors are detected, the program will then allow you print the schedules. It sounds like a lot of work, and it is. But it's important to ensure that your data set is as error free as possible.



Master Permit No. 0001

Banding Schedule

Master Permittee I.C. BYRDS, DR

FROM 822-70005
THROUGH 822-70100
REPORT ONLY CONTIGUOUS BAND NUMBERS

—**Banding Locations**—

A 1 mi W Laurel, Prince Georges Co., MARYLAND
B 1 mi N Rehobeth, Sussex Co., DELEWARE
C Monomoy Point, Monomoy Island, Barnstable Co., MASSACHUSETTS
D Patuxent WRC, 6 mi SE Laurel Prince Georges Co., MARYLAND
E Columbia, Howard Co., MARYLAND
F 2 mi N Potomac Village, Montgomery Co., MARYLAND

BAND PREFIX 822	COLOR MARKER CODE*	ALPHA CODE	SPECIES #	STATUS	AGE-SEX	REGION	LAT-LONG	LOC	DATE MO - DAY - YR
01									
02									
03									
04									
700 05	R/Y L G R	AMRO	761	301	AHY M	MD -146	390-0765	A	03-29-91
06	W L W/G R				F				
07	BLU L Y R				U				04-10-91
08	O L PI/W R				M				
09	G/Y L R R				F				
10		BLJA	477	300	U				
11					M				05-10-91
12					F				05-20-91
13									
14	LT G/BLU L			301	L U				
15	MAU/W R								
16	Replaces 763-09181			300	AHY M				
17		AMRO	761	301					05-25-91
18					F				
19				697*	HY U	DE -121	384-0750	B	06-30-91
20		KILL	273	300	L				
21									
22									
23	Y #27C	RWBL	498	639	ASY M				04-15-91**
24	Y #28C								
25	Y #29C				SY				
26	Y #30C				ASY				
27	Y #31C								
28	Y #32C								
29	Y #33C								
30	Y #34C				SY				
31	W/O L G R	BLJA	477	301	HY U	MD -146	390-0766	A	07-16-91
32		COTE	070	300	L	MA -147	413-0700	C	07-19-91
33									
34									
35									
36									
37									
38									
39									
40									
41									
42	BAND DESTROYED								
43		COTE	070	300	L U	MA -147	413-0700	C	07-19-91
44									
45	Replaces 573-?4825				ASY				
46	RED DYE	COTE		608					
47									
48									
49									
50									

Figure 38. An example of a correctly filled out banding schedule (from CWS 1991).

To ease the workload, some large-scale banding operations enter data on-the-spot directly into field computers, and do not bother with banding sheets. This can work well, but we recommend it with caution. The editing programs are not infallible and computers have been known to "crash," potentially losing all of your day's data. Also, a field station is seldom dirt or insect free, both of which are exceptionally hard on computers. We advise that you contact someone who has worked the "bugs" out of an in-house data entry system before embarking on it yourself. Manomet Bird Observatory (see Appendix A) appears to have a good system in place.

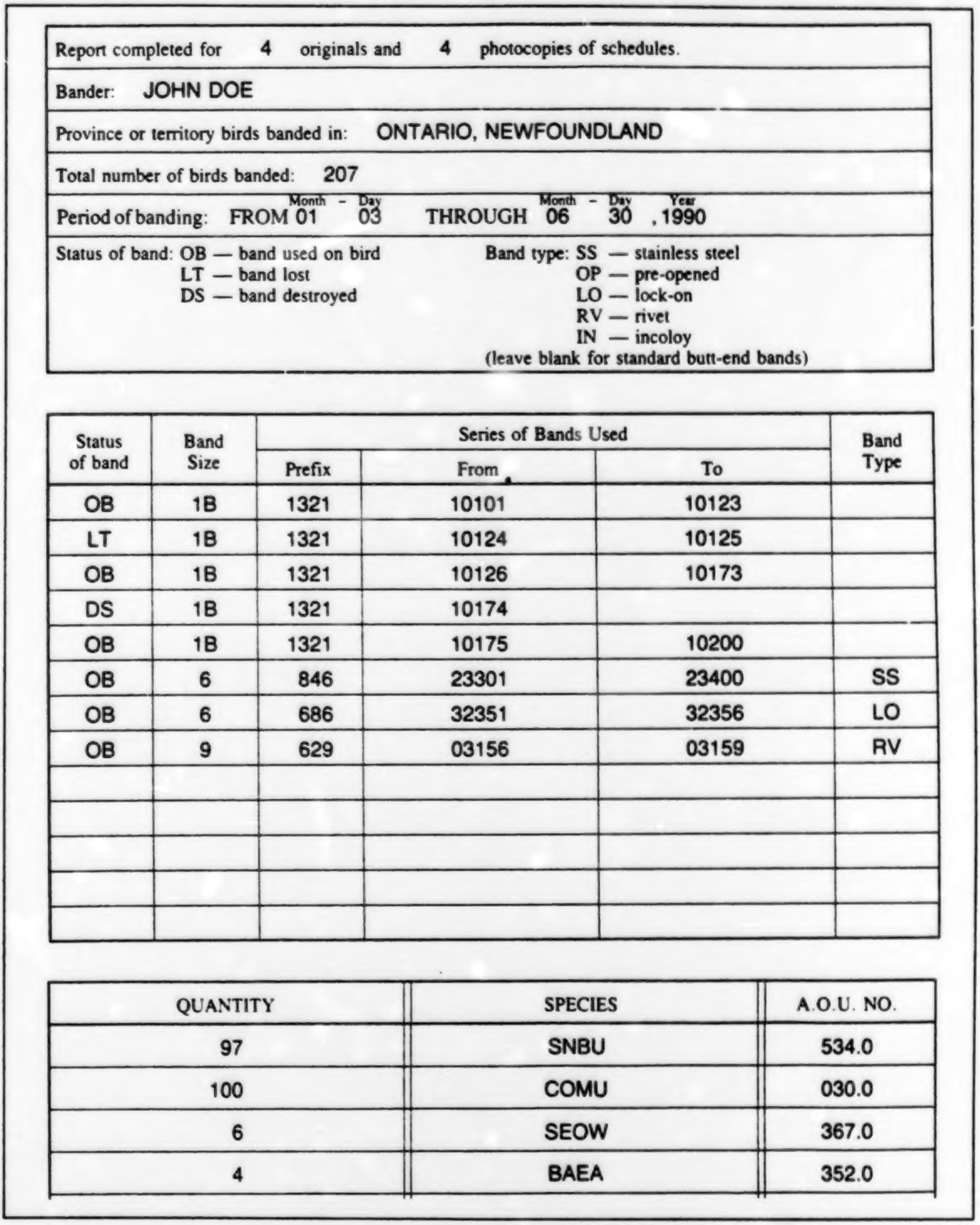
Other data entry systems use two people to enter duplicate data sets. Once all data are entered, a computer program cross-checks the two computer files and flags any inconsistencies between the two. This virtually eliminates key-punching errors, but it is time-consuming and may be expensive if paid personnel are used. In the future, easy to use "machine readable" banding sheets may be developed, allowing an electronic scanner to read and enter data into a computer.

Despite all of your efforts, errors do occur. If schedules have already been submitted, simply advise the Banding Office of errors. Upon receipt of the correct data, the original schedule will be corrected by the Banding Office. Don't submit new schedules.

The Banding Office may have questions concerning the data submitted on the Banding Schedules, and will return the original schedules along with an Inquiry Form that outlines any questions, comments or necessary corrections. You must return the schedules with the requested data. After complete processing of your schedules, you will receive an evaluation form which informs you whether your schedules required corrections and what those corrections were.

11.5. Note For File

A "Note For File" is submitted in duplicate, along with the Banding Schedules. It tabulates and summarizes the number and type of bands used and the species and number banded (Figure 39). If you are using computer-generated schedules, you do not have to include a hard copy of the Note for File, because it will be generated by the Banding Office's computer program. However, because of its usefulness, you will want to generate your own Note for your own records.



Report completed for 4 originals and 4 photocopies of schedules.

Bander: JOHN DOE

Province or territory birds banded in: ONTARIO, NEWFOUNDLAND

Total number of birds banded: 207

Period of banding: FROM Month 01 - Day 03 THROUGH Month 06 - Day 30 , Year 1990

Status of band: OB — band used on bird
LT — band lost
DS — band destroyed

Band type: SS — stainless steel
OP — pre-opened
LO — lock-on
RV — rivet
IN — incoloy
(leave blank for standard butt-end bands)

Status of band	Band Size	Series of Bands Used			Band Type
		Prefix	From	To	
OB	1B	1321	10101	10123	
LT	1B	1321	10124	10125	
OB	1B	1321	10126	10173	
DS	1B	1321	10174		
OB	1B	1321	10175	10200	
OB	6	846	23301	23400	SS
OB	6	686	32351	32356	LO
OB	9	629	03156	03159	RV

QUANTITY	SPECIES	A.O.U. NO.
97	SNBU	534.0
100	COMU	030.0
6	SEOW	367.0
4	BAEA	352.0

Figure 39. An example of a Note for File printout.

11.6. Recovery Information

All encounters of birds banded by people other than the Master Permit holder or sub-permittees should be reported to the Banding Office. Banders can also submit this form on behalf of members of the public who report band recoveries. The Banding Office issues "Certificates of Appreciation" to everyone who reports bands. This states the original banding information, and gives the name and address of the bander in case the observer wishes to obtain additional information.

The following types of encounters are to be reported:

i) Any bird banded by someone other than the master bander and his/her sub-permittees is called a **control** recovery.

ii) Any bird that is encountered outside of the 10-minute latitude-longitude block in which it was banded is called a **foreign** recovery.

iii) **Returns** are birds recaptured alive in the same 10-minute block in which they were first banded at least 90 days from the date of banding. Banders should keep track of these returns, but reporting them to the Banding Office is optional.

iv) If a banded bird was found dead, and it was banded in the preceding 90 days, and within the same 10-minute block, and before a schedule has been submitted, then the banding data should be deleted, and the band destroyed. "Band Destroyed" should be recorded on the Banding Schedule. If the schedules have already been submitted, inform the Banding Office; these records will be deleted from the data base.

v) Colour-marked birds should be reported to the Banding Office. Information to be reported includes the type of marker and its position, colour combination and code, age and sex if known, date and location of sighting. If there was a metal band on the bird's leg, its presence and position should be noted even if the band number could not be seen.

If someone has reported a band encounter, but no schedule for that band number has yet been reported, the bander will receive a card requesting data for that particular band number. This should be returned as soon as possible to the Banding Office, but the data must still be reported on a Banding Schedule.

12. PREVENTION OF INJURIES AND DISEASES TO BANDERS

12.1. Physical Risks

Herons, cormorants and loons are able to strike with the bill at incredible speed, often targeting the intruder's eye. Banding these birds is often best done with two people, one to secure the bill while the other bands. Failing this, ensure that the bill is securely tucked under your arm before commencing banding.

Swans, particularly male Mute Swans, can be violent during the breeding season, even if you are not attempting to catch them or their young. The attack consists of a full frontal assault with open wings. They are very powerful birds, and banding is a two-person process.

Most species of gull, tern and jaeger can be surprisingly aggressive near the nest. A typical attack is to dive on the intruder and strike with the bill. These birds can inflict considerable pain. A hard hat can be worn, but this is uncomfortable on hot days. An alternative is to carry a stick, perhaps with an old toque on top. The birds will quite happily change to focusing on the higher object. Large gulls (e.g. Herring and Great Black-backed) and jaegers can inflict a painful bite and can easily draw blood.

Some species of hawks and owls (especially goshawk and Great Horned Owl) can be extremely aggressive near their nests. A hard hat and safety glasses are strongly recommended when attempting to band nestling raptors, and a leather or very thick jacket could offer some protection against those species that like to rake intruders with their hallux talon.

Most hawks and owls can inflict varying amounts of damage to your hand from their bills or talons. In general, accipiters, buteos and owls are more dangerous with the talons, while falcons rely more on their bills, which are noticeably notched. To put the potential danger in perspective, the Great Horned Owl, admittedly the most powerful North American raptor, has been demonstrated to possess talon-grasping power of 2400 lbs/sq. in. which, in a press, is sufficient to bend ¼" steel plate!

It is impractical (and often ineffective) to use leather gloves to handle raptors. When extracting a raptor from a mist net, the bird's attention should be diverted while the legs are grabbed. This can either be done by a second person, or by the bander waving a hand so the bird looks away from the hand that is to grab the legs. From this point on, the bander must concentrate on not releasing or even easing the grip on the legs while the bird is freed. Once out of the net, rather than putting the bird in a bag and having to go through the procedure of grabbing the legs a second time, it's better to hold the bird in the "ice-cream cone" grip (Figure 4). This entails holding the thighs, tail and wing points firmly in one hand. Even birds as large as a Red-tailed Hawk can be held in this manner. The bird is effectively immobilised: it cannot strike with its talons, flap its wings or bend down to bite you.

For sharp-taloned birds, the banding process is best carried out either by inserting the bird head-first into an appropriate sized can or by placing the bird on its back on the bander's thighs (with the talons away from the body.) and covering the head with a cloth. Some banders recommend giving raptors a stick to hold in their talons, but this can lull you into a false sense of security since the bird can drop the stick and grab you at any time.

With the exception of shrikes, which can and will draw blood, most songbirds are quite harmless. Large-billed seed-eaters (e.g. cardinals and grosbeaks) can inflict painful bites, though rarely will they draw blood. One way to reduce their mobility is to use the "straitjacket" grip. This is a variation on the standard bander's grip, where the head is held nearer the tips of the first and second fingers which are then straightened somewhat.

A number of species such as jays, starlings and most icterids have strong toes and sharp claws. Banding numbers of these can take its toll on banders' hands. Scratches can be lessened by using another variation on the bander's grip, where the legs are immobilized between the third and fourth fingers for most of the banding operation. The birds can also be given a stick to hold, but this is invariably a temporary solution. It is usually best just to accept the scratches and process and release the bird quickly.

An injury to a bander in the field is not only unfortunate for the person concerned. If the bander is alone, it may be difficult, if not impossible, to remove any remaining birds in nets and close down. At all times, steps should be taken to minimize the chance of trips or falls. Clear logs and branches off paths around the netting area, cut any stumps right down to ground level, and mark any guys with flagging tape.

A long day of extracting and banding can be quite punishing on the eyes; tired eyes make mistakes. If you need glasses for reading, make sure that you use them when banding. The size 0 bands are difficult to read even if your eyesight is good!

12.2. Diseases and Disorders

Birds may suffer from a number of infections. Most of these, fortunately, are peculiar to birds, but some may be shared with other animals, including humans. Some of the more likely candidates are discussed below, but the list is by no means definitive. Banders contracting curious complaints are strongly advised to inform their doctor of their contact with wild birds. As a general precaution, regular washing of the hands with carbolic or other germicidal soap is recommended, especially before eating or smoking. Never place bird bags in the mouth and avoid inhaling dust from bird bags or boxes, which should be washed or cleaned out regularly.

While Chlamydiosis (Ornithosis and Psittacosis) is primarily associated with imported cage birds, there is evidence that it is widespread in wild birds in some regions. It can be communicated to humans, where it causes a fever with lung inflammation.

Salmonellosis is a bacterial infection, common in mammals and birds. In humans, it is most likely to be contracted from the faeces of birds frequenting garbage dumps, feed lots and bird feeders. Since it is commonly found in dead birds that are simply "found dead," personal hygiene is especially important after handling dead birds. Symptoms are acute enteritis and diarrhoea.

Any field worker should be immunized against polio and tetanus, the more so if they are working with birds near garbage dumps, sewage plants or potentially polluted water. In recent years there has been concern with the increase in Tuberculosis cases in Canada. Birds can be carriers of the human form of the disease. All banders should be immunized.

Lyme Disease is caused by a bacterial spirochaete that is transmitted by a bite from the deer tick. Banders operating in an area known to harbour the disease (e.g. parts of Ontario) should be aware of the danger and alert to the first signs of an infected deer tick bite. Any sign of a bull's-eye rash around a tick bite, should be immediately investigated as the sooner the disease is confirmed and treated, the greater the chance of a complete recovery. Learn to recognize what a deer tick looks like; if you are bitten by one, consult a doctor.

Rabies is potentially communicable, not via birds, but from bats caught incidentally during netting. Any bander suffering a bite from a bat is advised to seek medical treatment. In high risk areas, banders may be advised to get immunized against rabies.

Banders should be aware of poisonous plants occurring in their banding area. In Canada, poison ivy is the most likely species to be encountered, especially when banders are clearing undergrowth for net lanes. "Grackle Pox" is a rare affliction which is essentially a case of subcutaneous poison ivy. It is characterized by intensely itchy, weeping blisters on the backs of the hands and fingers. It can result in a bander's hands becoming so swollen as to preclude further activity. It is caused by the skin being punctured by the claws of strong-footed species such as grackles and Blue Jays (which have been foraging in patches of poison ivy), allowing the toxin to penetrate under the skin. Treatment is with cortisone cream. Sunlight exacerbates the condition considerably. Prevention is effected by care during handling and by frequent hand washing, preferably using a carbolic soap. Naturally, it is important to ensure that baited traps are not placed in a patch of poison ivy!

13. VISITORS AND PUBLIC RELATIONS

Banding operations often have visitors, and some operations are very public. Banding should never be a secretive "hush-hush" operation. Instead, banding provides lots of opportunities to educate the public about birds and conservation. Many people go away with a new found attitude and sensitivity towards birds. Still, it is important to understand that problems can arise if the operation is not well thought out and if it is in any way sloppy.

13.1. Problems

Unless you exercise control, the negative impacts resulting from large numbers of visitors at a banding station can outweigh the positive ones. These range from increased bird stress to parking problems.

Bird stress can be heightened by large numbers of visitors in several ways. First, the time it takes to process birds can be dramatically lengthened due to staff-time being spent interacting with visitors. Under such circumstances, birds could be held for inordinate periods of time. Also, net checks are apt to be delayed, meaning that birds become more entangled and more stressed by weather and other factors. The sheer presence of visitors creates stress on the birds, because birds simply view people as frightening "monsters." There is no question that birds which are subjected to intense scrutiny by mobs of monsters, all understandably eager to photograph and pet them, are stressed. Some visitors even go so far as to try to free birds from mist nets!

There can be an associated increase in the number of casualties if all of the above stress factors are not wisely considered. Injuries and mortalities must be kept to an absolute minimum in any banding operation, but even more so in public surroundings. Needless to say, any hint of injury creates enormous public relations difficulties.

An average encounter with a visitor can easily last 10 minutes. Hence, if you have lots of visitors, then you can wind up spending a lot of time dealing with them, meaning that you'll need more personnel on hand to get the banding job done. You might choose to hire a special person to deal with visitors. However, the presence of such a person and a beefed-up educational program can wind up heightening public demand.

Be aware that visitors provide an easy form of distraction during the banding operation, increasing the number of errors in data recording and causing general mix ups (e.g. putting the wrong size band on a bird, forgetting to weigh the bird, etc). And dealing with large numbers of visitors is tiring and stressful for your station personnel. Visitors can also interfere with station logistics.

Training personnel can be greatly impeded by a lot of visitors. Trainees are not able to get the hands-on, one-on-one supervision they require due to public scrutiny and interruptions.

Large numbers of visitors create parking problems and generally stress the site (e.g. through trampling of vegetation and leaving garbage). People in net-lane areas sometimes damage mist nets, usually inadvertently, but sometimes intentionally. And people will want to use your toilet facilities. Expect to spend extra time cleaning up and doing general chores.

Finally, you must also pay attention to the needs and privacy of any neighbours you might have, regarding increased vehicular traffic, noise and people wandering onto their properties.

13.2. Some Solutions

One of the tricks is to limit the number of visitors your operation can accommodate. To do this, post times of the day when your site is open to the public, and prearrange any group visits well in advance. And think carefully before you decide you want to advertise your station. You may very well be swamped by busloads of tourists.

Many operations don't allow public access to their net lanes. Others post a large sign at the site, informing the public about what goes on, the fact that nets and traps are checked every 20 minutes or so, and politely asking visitors to abide by a few rules regarding pets, the fragility of nets, and birds in nets.

It is often necessary to scale back the banding operation during peak visitor periods (e.g. on weekends and holidays). In general, on any day you are open to the public, both the bird and the visitor situation should be gauged. If there are lots of birds and/or visitors, then the banding operation **must** be scaled back accordingly. It will very much be a daily judgement call.

Under no circumstances are you to sacrifice a bird's safety in the name of providing showy banding demonstrations. All banding operations put the bird's safety first and foremost. If this simple rule is followed, visitors will sense where your priorities are and there will be few if any conflicts. If your netting area is open to the public, you must keep a constant vigil and make exceptionally frequent net checks (as often as every 15 minutes). Apart from minimizing any danger or stress to captured birds, this will also reassure visitors that you are indeed concerned and very much on top of the situation.

13.3. Banding Demonstrations for the General Public

Formal banding demonstrations should be conducted in a special area of your banding lab, during certain hours only (e.g. from 10:00 a.m. to 12:00 p.m.), or by special arrangement. Visitors should not be permitted inside the portion of the room where the banders are working, if only to give the banders room to work and to prevent any jostling. The banders and the visitors should be separated by some kind of divider — a counter top works fine. The banding lab can have two doors — one for "employees only" and another for visitors. This directs the visitor traffic into the right part of the room.

Only well-trained, experienced banders should give demonstrations; trainees can scribe and generally help out until they're sufficiently adept at the entire process. The demonstrator runs through the process slowly at first, describing everything that's going on as it's being done, as well as interesting facts about the bird itself. The bird's safety should be stressed at all times. If you think that the demonstration is eating into valuable time that should normally be devoted to a net check, get someone to do a quick net run. Remember that nets must be checked every half hour.

A banding station is **not** a petting zoo or a circus! Never let visitors (especially kids) handle or touch birds, though they can photograph them while you hold them, providing that it is done quickly and doesn't get out of control. Some people insist on poking their fingers at the bird and before you know it everyone is doing it and it really is quite upsetting to the bird. Moreover, the bird will probably bite. Emphasize that your program is always sensitive to the physical and emotional health of the birds being handled. You never put birds through any more stress than is absolutely necessary. Your visitors will understand and appreciate your concern and your careful handling.

13.4. Group Visits

Group visits (seniors, children, nature clubs, etc.) can be educational and even fun. Groups are booked in as circumstances permit, generally on dates or times when the site is closed to members of the general public. Group size is generally limited to a maximum of 30 people; 15 is a nice size to work with at one time.

Groups are usually handled for about 1 hour, during which time they are given a brief introduction about the banding station, its programs and the role of bird banding. This may be followed by a guided walk around the net lanes and finishes off with a banding demonstration. Again, only the most experienced banders should be doing most of the hands-on work in front of groups.

When groups are scheduled, make sure that there are not too many nets open, keeping in mind that groups take time and that you don't want to get a back-log of birds. Consider scaling the typical netting operation back by one-half.

At least two people are required to handle a group, and three is better. When taking a tour of the net lanes, remind the group frequently not to touch the nets or the birds. Take charge! Visitors should watch that their buttons don't get caught up in the nets.

During the net-lane tour, an experienced person acts as the leader, does most of the talking, and does most (or all) of the bird extractions. Another person generally helps out, often bringing up the rear to make sure there are no laggards and to keep an eye on the people who inevitably get buttons caught on the nets, or poke at the birds or nets, or try to venture off by themselves. While the leader is stopped for a while at a particular net, the other person should grab the opportunity to take a quick solo dash around some upcoming nets, to make sure there are no problems. Any upcoming difficulties can then be relayed (quietly) to the leader who might choose to avoid a particular net. If the other person can extract difficult birds quickly before reporting back to the leader, then so much the better.

The helper should also be on the lookout for nets that are catching too many birds, and should start to extract the birds and/or close more nets if necessary. Again, it is important that not too many nets are open when visitors are present and to remember that visitors are going to slow you down so that you won't be able to process nearly as many birds as quickly as you could otherwise. Plan ahead and you'll minimize any problems.

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APPENDIX A. ASSOCIATIONS AND BIRD OBSERVATORIES

1. Ontario Bird Banding Association (OBBA)

The OBBA covers the province of Ontario, but because it is the only Banding Association operating from Canada, it is of special interest to all Canadian banders. Publications: *Ontario Bird Banding Association Newsletter* (quarterly) *Ontario Bird Banding* (annually).

2. Eastern Bird Banding Association (EBBA)

In Canada, the EBBA includes Ontario, Quebec and the Maritime Provinces. Membership information can be solicited from the Treasurer of the Association, currently Donald Mease, 2366 Springtown Hill, Hellertown, PA 18055. Publication: *North American Bird Bander* (quarterly)

3. Inland Bird Banding Association (IBBA)

In Canada, the IBBA covers Manitoba and Saskatchewan. Membership information can be solicited from the Treasurer of the Association, currently Tom Bartlett, P.O. Box 832, Tiffin, OH 44883. Publication: *North American Bird Bander* (quarterly)

4. Western Bird Banding Association (WBBA)

The WBBA covers Alberta, British Columbia, Northwest Territories, and the Yukon. Membership information can be solicited from the Treasurer of the Association, currently Kenneth Burton, P.O. Box 848, Point Reyes Sta. CA 94956. Publication: *North American Bird Bander* (quarterly)

5. North American Bird Observatories Which Have Bander Training

For more information about training opportunities in Canada, contact the Ontario Bird Banding Association or the Banding Office.

a) **Beaverhill Bird Observatory** 18624 70th Avenue, Edmonton AB, T5T 2V8.

b) **Cape May Bird Observatory** New Jersey Audubon Society, P.O. Box 3, Cape May Point, New Jersey 08212.

c) **Long Point Bird Observatory** P.O. Box 160, Port Rowan ON, N0E 1M0, Canada. Phone: (519) 586-3531 FAX: (519) 586-3532

d) **Manomet Bird Observatory** Box 936, Manomet, Massachusetts, 02345, U.S.A. Phone: (508) 224-3559

e) **Point Reyes Bird Observatory** 4990 State Route, Stinson Beach, California, 94970, U.S.A. Phone: (415) 868-1221

f) **San Francisco Bay Bird Observatory** Box 247, Alviso, California, 95002, U.S.A. Phone: (408) 946-6548

g) **Thunder Cape Bird Observatory** c/o Sleeping Giant Provincial Park, RR #1, Pass Lake, Ontario P0T 2M0.

i) **Whitefish Point Bird Observatory** HC 48, Box 115, Paradise, Michigan, 49007. Phone: (906) 492-3954.

APPENDIX B. SOURCES OF BANDING EQUIPMENT[1]

Mist Nets: These are available from any of the following suppliers:

1. Northeastern Bird Banding Association, c/o Manomet Bird Observatory, Box 936, Manomet MA, 02345, U.S.A.

2. Eastern Bird Banding Association Net Committee, c/o Gale Smith, R.D. #2, Box 131, Kempton PA, 19529, U.S.A. Phone: (215) 756-4311

3. Avinet, Box 1103, Dryden NY, 13053, U.S.A. FAX and phone: (607) 844-3277

4. British Trust for Ornithology, The Nunnery, Nunnery Place, Thetford, Norfolk, IP24 2PU, England. Phone: 0842 750050

5. Spidertech Bird Nets, The Owl Engineering Group, 1-Roobertinkatu 33 D 34 SF-00120 Helsinki, Finland. Phone: 358-(9)0-444692

Mist Net Poles: Available from Avinet (see above) or from any electrical supply store.

Wing Rules: Available in three sizes (15 cm, 30 cm and 60 cm) from Chris N. Rose, 98 Lopez Road, Cedar Grove NJ, 07009, U.S.A. (201) 256-4410, and from the British Trust for Ornithology (see above).

Banding Pliers: Holes in jaws to fit standard band sizes, with a split pin on top for even band opening. Available in three sizes (band sizes 0 through 1A, band sizes 2 and 3, and band sizes 3B through 4) from Avinet (see above). Pliers for larger bands are available from Lambournes (B'ham) Ltd., Unit 1, Shallowford Court, Off High Street, Henley-in-Arden, Solihull, West Midlands, B95 5BY, England. Circlip pliers (for band removal) can be purchased from the BTO (see above).

Scales for Weighing: Electronic and triple beam scales are widely available from any scientific supply retailer, one of which is LabEquip, 330 Esna Park Drive, Unit 32, Markham ON, L3R 1H3. Phone: (416) 475-5880 FAX: (416) 475-1231. Pesola scales are available through Avinet (see above).

Calipers: Available from Avinet (see above).

Leg Gauges: Available from Len Soucy, 1390 White Bridge Road, Millington NJ, 07946, U.S.A. (908) 647-3018.

Bird Bags: Washable bags can be made, or cotton mailing bags can be purchased from BTO or Avinet (see above).

Coloured Leg Bands: Split plastic coloured leg bands are available from Avinet (see above) which import them from A.C. Hughes Ltd., 1 High Street, Hampton Hill, Middlesex, TW12 1NA, England.

Optical Device for Skulling: A good instrument is OptiVisor, a binocular magnifier (#6353-A12, A.H. Thomas Co., Philadelphia PA, 19105, USA).

Books of Interest to the Bander: Publication lists are available from the American Birding Association (PO Box 6599, Coloarado Springs, Colorado 80934; phone 1-800-634-7736), Avinet (see above), and the British Trust for Ornithology (see above)

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[1] The use of a name of a company does not imply that the Canadian government endorses this company's products. Note also that supplies may change; recent issues of banders' journals (Appendix A) should be consulted for up-to-date information and for suppliers of other kinds of markers not mentioned above.

APPENDIX C. A WELL-DESIGNED RESEARCH PROJECT

Dr. A.L.A. Middleton of the Zoology Department at the University of Guelph began banding a local population of American Goldfinches in 1968. Because of his project's duration and scope, Middleton has been able to make significant contributions to the knowledge of the biology of the American Goldfinch. Many of his findings are a direct result of the analysis of his own banding and recovery data, while other results incorporate banding data requested from the Banding Offices. Some of the features that make this a well-designed study are as follows:

a) Simple questions were asked; hypotheses were testable.
b) The study involved a large sample size.
c) Results were used to generate more questions.
d) Literature was used to suggest explanations.
e) Data were analyzed along the way to see if the question had been answered and to help define the question for the next step in the study.
f) Middleton didn't rely on other researchers to make sense or use his data.
g) Cooperators were involved to gather more data for specific purposes.
h) Results were published.

1. Moult and Plumage of the American Goldfinch and their Relation to Timing of Reproduction and Migration

Middleton (1977a) first studied the timing and sequence of moult in the American Goldfinch, because little was known about it and because its moult strategy appeared to be unique among other cardueline finches. The American Goldfinch is the only species to acquire its dimorphic alternate plumage through moult of the body feathers. In addition, the pre-basic and pre-alternate moult in the goldfinch is prolonged relative to other species of temperate zone passerines. Between 1970 and 1975, Middleton banded 3433 American Goldfinches at Guelph. He recorded the extent of moult of these individuals. He supplemented his field studies by closely observing a captive population of 12 birds held in an aviary.

In addition to providing a detailed account of the sequence and timing of moult in the American Goldfinch, Middleton found that males moulted about one week before females, that the post-juvenal moult was prolonged when compared to the pre-basic moult of adults, and that the post-juvenal moult enabled sex determination of young birds after about mid November of their hatch year. Middleton suggested that moult is initiated in males before it begins in females because the testes of males degenerate before the ovaries of the female.

In an attempt to understand the relationship that may exist between the goldfinch's late nesting and prolonged moult, Middleton suggested that, while other species of cardueline finches acquire their alternate plumage through abrasion, the American Goldfinch is the only species with the time in its annual cycle to go through a complete body moult prior to nesting. Because the energy demands of moult are so high, moult delays the development of the gonads, which then delays nesting and reproduction. The fact that moult occurs over a prolonged period suggests that the goldfinch has adapted to acquire the protein requirements necessary for moult from an exclusively graniverous diet, therefore avoiding possible nutrient stress at times of unpredictable weather and food availability.

Middleton continued his study of the annual cycle of the American Goldfinch, using moult data from the 3433 banded birds, an additional 371 birds trapped at nests, as well as moult data from 200 birds collected for gonadal study (Middleton 1978). He found that male gonadal development slightly precedes that of the female. Therefore, males do enter into breeding condition before females. Middleton detailed the timing of moult, gonadal development and migration and presented further results which suggest that moult itself may be controlled by photoperiod. However, it is the timing and duration of moult which affects other prominent events of the goldfinch's annual cycle. This is because energy requirements for moult are high and preclude additional energy from being expended for reproduction or migration before the flight feathers are moulted.

Middleton (1977a) hypothesized that the pre-alternate moult enables the goldfinch to develop a less dense summer plumage, which is beneficial to a species that inhabits open areas in the hot dry months of the summer. Middleton (1986) studied the plumages of collected goldfinches and found that the basic (winter) plumage of the American Goldfinch was significantly heavier than its alternate (summer) plumage. This difference was attributed to a difference in summer versus winter feather structure. Feathers of the basic plumage were more dense and downy, giving them greater insulating ability.

2. Age and Longevity of the American Goldfinch

It is generally accepted that, as a result of the high mortality experienced by wild passerines living in temperate climates, few passerine species survive much in excess of 7 years. Their expected survival can increase when kept in captivity, however, to between 11 and 15 years or more. Middleton's own records of the survivorship of colour-banded American Goldfinches reflected these expected ages of survival. Although his data suggested that individuals living under natural wild conditions survived to between 4 and 6 years of age, Middleton (1984) analyzed data taken from the Recovery Retrieval File of the Bird Banding Laboratory to obtain a more accurate indication of survivorship in the North American population of the American Goldfinch. He used data of recoveries and recaptures of goldfinches recovered 5 years or more after they had been banded to formulate a survival curve. This curve showed that the majority of birds survived to between 5 and 7 years, and that the oldest birds did not live beyond 11 years. Those banded or recovered in Canada did not live beyond 6 years, whereas those recovered in more southerly locations could be expected to live longer. Middleton notes that these results support Welty's (1982) earlier suggestion that birds living in harsher climates have shorter life expectancies.

3. Age and Sex of the American Goldfinch in Relation to Winter Distribution, Breeding Habitat and Reproduction

Using the aforementioned banding data, Middleton (1977c) used capture and recapture techniques to derive an estimate of the overwintering population of goldfinches in Guelph. These data showed that 853 to 1816 American Goldfinches overwintered in the study area. By comparing his results to Christmas Bird Count data, Middleton was able to show that populations of overwintering goldfinches in Ontario had been steadily increasing over the years. He suggested that the increasing availability of winter food (due to an increase in the number of bird feeders) enabled goldfinches to survive long harsh winters.

Middleton (1990) used banding data requested from the Banding Office to examine the geographical, age and sex distributions of wintering American Goldfinches. These data were requested from the Banding Retrieval File for original bandings of American Goldfinches from 1975 to 1985. Banding data were available previous to that period, but ageing techniques for male goldfinches were not known before Middleton's paper. Moreover, because ageing techniques for females were not developed until after his study was completed (Pyle *et al.* 1987), Middleton pooled all female goldfinches for his analysis. The sex distributions of wintering birds could therefore be analyzed. However, only the age class distribution of wintering males could be examined. Data were selected for those birds banded during January and February, when the populations are least likely to be migratory, and for those birds banded east of 100° longitude, where the majority (over 90%) of all bandings occurred.

Middleton's own banding data suggested that the Guelph breeding population migrated south, and that the city's wintering population consisted of migrants from farther north. In fact, results showed that male American Goldfinches wintered farther north than females and that young males wintered farther north than adult males. Recapture data suggested that age and sex distributions of wintering birds result from different distances flown from the breeding grounds. Currently accepted hypotheses explaining differential migration (Myers 1981; Ketterson and Nolan 1983) could not explain why younger males winter farther north than adult birds. Middleton (1990) suggests that young birds are not physiologically or behaviourally able to migrate long distances from their breeding grounds.

In an attempt to discern the influence of age and sex on reproductive success and choice of nesting habitat, Middleton (1979) trapped American Goldfinches breeding in three distinct habitat types at Guelph. He placed coloured leg bands on each bird. Between 1968 and 1975, breeding populations were studied in a residential area of the city, in an old field natural habitat and in a tree nursery, where cultivated saplings were evenly spaced. Observations of colour-marked individuals showed that males often changed nesting sites from breeding season to breeding season, whereas females often showed a high degree of fidelity to their original nesting site. Monogamous pair bonds lasted the duration of the breeding season, but broke down during migration and wintering. Often, goldfinches changed mates from year to year.

Nesting began in early July and continued until August with a mean clutch size of 5.3 eggs. Older birds, regardless of sex, were more successful than younger birds. Older females produced larger clutches, fledged a greater number of young per nest, and had a higher number of successful nests than known second year or unknown aged birds. Older females were responsible for a majority of early nests. In pairs where both the male and the female were old birds, more fertile eggs were produced per clutch and more young fledged successfully than in younger pairs.

The city habitat showed the highest nesting and fledging success. As well, city nests suffered a lower predation rate and lower incidences of parasitism by Brown-headed Cowbirds than nests located in the other habitats. Reproductive success was next highest in the natural old field habitat and lowest in the nursery.

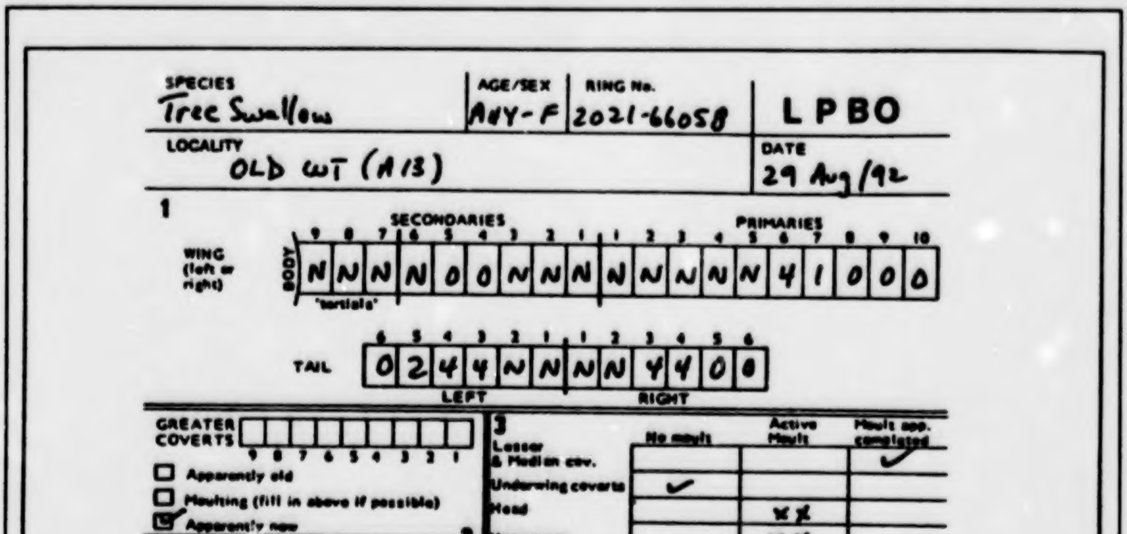
APPENDIX D. MOULT CARDS

Little is known about the timing, sequence and extent of moult in many North American species. Because this information can be extremely useful for ageing birds, banders are wise to collect and analyze these data. Moreover, since most banders don't get large enough sample sizes of moulting individuals of single species, there is lots of scope for cooperative studies.

There are several different ways in which moult can be recorded. The following system was developed by the British Trust for Ornithology. Moult cards (Figure 40) are completed for each bird showing active moult, even if the moult is only partial. Many juveniles show only partial body and/or flight feather moult, and banders cannot afford to lose information on the timing and extent of moult for any age class of any species. One card is filled out for each bird. Recaptures are treated as new birds and are given a new card each time moult is recorded, except if they are captured more than once on the same day. Naturally, cards from the same individual should be filed together. Cards can be filed by band number or by band number within each species.

Conventionally, the primaries are numbered in ascending order, beginning with the innermost feather, in accordance with the sequence in which the feathers are normally replaced. Likewise, secondaries are numbered in ascending order, beginning with the outermost secondary and proceeding towards the body. Tertials are numbered as part of the secondary row, because these feathers are morphologically of the same origin. Tertial moult is most difficult to master; it takes practice to detect which feathers are missing and to find tertial pin-feathers.

Figure 41 shows a typical passerine wing in active moult, with all feathers numbered conventionally. Sections 1, 2 and 3 of the moult card are to be filled out in numerical order. If time is short, some data are more useful than no data. In these cases, it may be more useful to complete section 1 for many birds than to complete entire cards for only a couple of birds.



SPECIES Tree Swallow

AGE/SEX AHY-F

RING No. 2021-66058

LPBO

LOCALITY OLD CUT (A13)

DATE 29 Aug/92

1

WING (left or right)

	SECONDARIES									PRIMARIES									
BODY	9	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	9	10
	N	N	N	N	0	0	N	N	N	N	N	N	N	N	4	1	0	0	0

'tertials'

TAIL

LEFT						RIGHT					
6	5	4	3	2	1	1	2	3	4	5	6
0	2	4	4	N	N	N	N	4	4	0	0

2

GREATER COVERTS ☐☐☐☐☐☐☐☐☐ 9 8 7 6 5 4 3 2 1

☐ Apparently old

☐ Moulting (fill in above if possible)

☑ Apparently new

BASTARD WING (ALULA)

☐ Apparently old

☐ Moulting

☑ Apparently new

3

	No moult	Active Moult	Moult app. completed
Lesser & Median cov.			✓
Underwing coverts	✓		
Head		✗✗	
Upperparts		✗✗	
Underparts		✗✗	

OBSERVER David Hussell

Figure 40. An example of a correctly filled in moult card.

Instructions for Completing Moult Cards

Wing and Tail ("Flight Feathers")

Use the following notation:

0	old feather
1	feather missing or new feather in pin
2	new feather up to one-third grown
3	new feather up to two-thirds grown
4	new feather nearly fully grown
N	new feather that is fully developed

Moult in the wings and tail should proceed symmetrically. If moult is not "in-phase" in the two wings, divide the squares with an oblique stroke (/). Use the space above the stroke to represent the left wing, and the space below the stroke to represent the right wing.

Greater and Primary Coverts and Alula (or "Bastard Wing")

Notation to describe moulting coverts is identical to that used to describe flight-feather moult. Each covert overlies its corresponding flight feather.

Lesser and Median Coverts and Body Moult

Appropriate boxes are marked with a check mark. Active moult in the head, upperparts and underparts may be further qualified as follows: **X** slight moult; **XX** moderate moult; and **XXX** heavy moult.

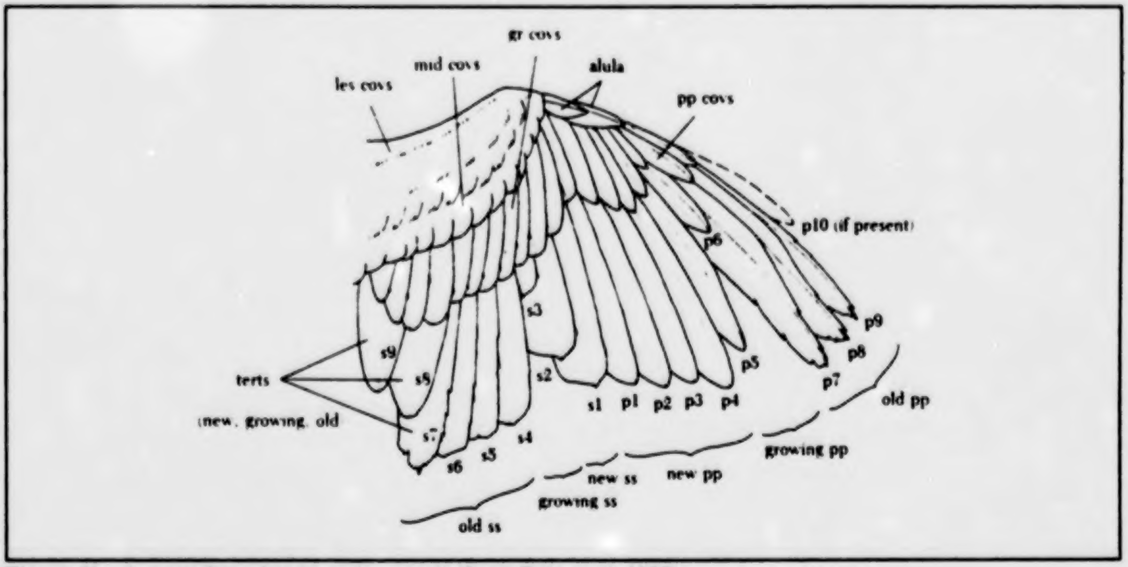

gr covs
mid covs
les covs
alula
pp covs
p10 (if present)
p6
s3
p9
p8
p7
old pp
s9
terts
s8
s2
p5
s1
p1
p2
p3
p4
(new, growing, old
s7
s4
s6
s5
growing pp
new ss
new pp
growing ss
old ss

Figure 41. A passerine wing in active moult (from Pyle *et al.* 1987).

APPENDIX E. THE BANDER'S REPORT CARD

Not all categories need to be checked (initialled) for a banding permit. However, some categories are fundamental and need to be assessed for all prospective banders. These are identified by an asterisk. Items with double asterisks are essential elements for prospective Master Permittees.

The trainee can . . .

		Required Items	Traine Initia
	BACKGROUND MATERIAL		
1. Understand the ethics of banding birds		*	
2. Understand how banding fits into scientific studies		*	
	CHECKLIST OF PRACTICAL SKILLS		
1.	**PROCESSING**		
1.1	**Identification and handling**		
1.1.1	Recognize all target species and release a bird unbanded if identification cannot be made with 100% certainty	*	
1.1.2	Appreciate the importance of minimizing handling time while not compromising safety	*	
1.1.3	Use the bander's grip on a variety of species	*	
1.1.4	Use the photographer's grip safely	*	
1.1.5	Use the "ice cream cone" grip safely	*	
1.1.6	Transfer a bird from hand to hand safely	*	
1.1.7	Open a bird's bill reliably	*	
1.1.8	Handle a variety of awkward species	*	
1.1.9	Release a variety of species correctly	*	
1.1.10	Effectively deals with escaped birds in an enclosed space	*	
1.2	**Banding**		
1.2.1	Select correct band size	*	
1.2.2	Read band numbers correctly	*	
1.2.3	Apply a band correctly	*	
1.2.4	Correctly apply a lock-on band (if appropriate)		
1.2.5	Correctly apply a colour band (if appropriate)		

The trainee can . . .

		Required Items	Trainer's Initial
1.2.6	Recognize when and how to correct an improperly applied band	*	
1.2.7	Know when and how to remove a band safely	*	
1.3	**Storing/carrying birds**		
1.3.1	Use the appropriate method of storage for particular species	*	
1.3.2	Place birds in bags and carry and hang them correctly	*	
1.3.3	Recommend when bags/boxes need cleaning	*	
1.4	**Field data collection**		
1.4.1	Record data clearly, legibly and accurately on field sheets	*	
1.4.2	Recognize and take description of and/or photograph rarities or unusual birds	*	
1.4.3	Maintain complete and accurate daily logs	*	
1.5	**Biometrics**		
1.5.1	Use and accurately read measuring devices (wing rule, balances, callipers, dividers)	*	
1.5.2	Correctly and accurately measure various anatomical features	*	
1.5.3	Assess simple wing formulae		
1.5.4	Assess and record moult accurately on a moult card		
1.5.5	Accurately score fat deposits		
1.6	**Ageing and sexing**		
1.6.1	Correctly use guides for ageing and sexing	*	
1.6.2	Accurately score skull ossification		
1.6.3	Correctly use other characteristics for age determination		
1.6.4	Understand and assign correct age codes	*	
1.6.5	Correctly use colour, size, brood patch, and cloacal protuberance for sex determination	*	
2.	**SPECIAL AUTHORIZATION FOR MIST NETTING**		
2.1	**Erecting, opening and closing nets**		
2.1.1	Choose an appropriate netting site and appropriate net		
2.1.2	Correctly set up nets unaided		
2.1.3	Properly furl and unfurl nets		

The trainee can . . .

		Required Items	Train Init
2.1.4	Take in and store nets and associated equipment properly		
2.2	**Operation and Extraction**		
2.2.1	Judge how many nets to safely use and checks them frequently and carefully		
2.2.2	Demonstrate an astute, accommodating approach to extraction		
2.2.3	Extract a variety of species quickly and safely		
2.2.4	Deal proficiently with tricky situations		
2.2.5	Recognize/maintain nets that are in poor condition		
3.	**TRAPS**		
3.1	Has knowledge of range of traps and their target species		
3.2	Operate traps properly and safely		
4.	**NESTLINGS**		
4.1	Follow species and date/age guidelines in Banding Manual		
4.2	Approach nests responsibly and remove, handle, band and replace nestlings safely		
5.	**ETHICS AND INJURIES**		
5.1	Know and practice the Bander's Code of Ethics	*	
5.2	Show excellent awareness of injury prevention	*	
5.3	Show familiarity with the most common injuries and their causes	*	
5.4	Demonstrate ability to treat minor injuries	*	
5.5	Recognize and demonstrate the necessity for euthanasia	*	
5.6	Assess whether a specimen is worth preserving	*	
5.7	Record details of all injuries and casualties	*	
6.	**HEALTH AND SAFETY OF BANDERS**		
6.1	Demonstrate a responsible attitude towards potential injuries from birds	*	
6.2	Demonstrate a responsible attitude towards physical hazards in the banding area	*	
7.	**DATA MANAGEMENT**		
7.1	Proof and correct banding sheets	**	
7.2	Complete banding schedules properly and unassisted	**	
7.3	Handle other paperwork correctly and promptly	**	

The trainee can . . .

		Required Items	Trainer's Initial
8.	**PUBLIC RELATIONS**		
8.1	Communicate effectively with the public about banding	*	
8.2	Communicate effectively using banding data (reports, articles etc.)	**	
9.	**OTHER SPECIAL AUTHORIZATIONS**		
9.1	Demonstrate proficiency in the following special authorizations (specify):		
10.	**FINAL GRADING**		
10.1	Ethics	*	
10.2	Processing	*	
10.3	Special Authorization for Mist netting		
10.4	Traps		
10.5	Nestlings		
10.6	Injuries to Birds	*	
10.7	Health and Safety of Banders	*	
10.8	Record Keeping	**	
10.9	Public Relations	*	
10.10	Other Special Authorizations (specify):		

TRAINER'S RECOMMENDATIONS

I ________________________________ (name of trainer) have trained and witnessed ____________________ (name of trainee) and am satisfied that all necessary training has been successfully completed and that he/she qualify for a:

Subpermit ☐

Master permit ☐

to band the following species groups:

waterfowl ☐
seabirds ☐
shorebirds ☐
raptors ☐
landbirds ☐

with the following authorizations:

to use mist nets ☐

to use cannon nets ☐

to use chemicals ☐

to use colour marking ☐

to use radio transmitters ☐

to band endangered species ☐

to take blood samples ☐

Signed: ________________________________ (trainer) Dated: ____________________

Permit # ____________________

Special Species or Trapping Restrictions (please list):

Other Comments:

APPENDIX F. MORE INFORMATION ABOUT MOULTS/MOLTS

The accompanying figure illustrates, in schematic form, the first four calendar years in the life of a typical passerine. This chart applies to species such as Yellow Warbler, Scarlet Tanager, and Indigo Bunting that have distinct alternate (breeding) plumages. Species without such plumages differ from this pattern in various ways that will be discussed below.

While the bird is in the nest, it attains and, to a large extent, loses its natal down. By the time it fledges, the bird is predominantly in juvenal plumage (JP). It is aged "Local" (L or 4) until it becomes capable of sustained flight (soon after fledging), at which point it is known as "Hatch-year" (HY or 2). It retains its JP until its first prebasic molt (PB), when it molts into its first basic (winter) plumage. In most species, this molt is partial; i.e., the juvenal flight feathers and primary coverts are retained, and these often have a distinctive shape and color, respectively. Note that the bird remains in the HY age class through the first calendar year.

On January 1, the bird becomes "Second-year" (SY or 5), although it is still in its first basic plumage. Nothing has changed but the date! During the spring of its second calendar year, it undergoes its first prealternate molt (PA) into its first alternate plumage. This molt is partial or limited, so the juvenal flight feathers and coverts still are retained. The bird is still identifiable as SY because the first alternate plumage differs in some way from later alternate plumages, even if only in the retention of the above-mentioned juvenal feathers.

Following the bird's first breeding season, it undergoes its second PB into its second basic plumage. This molt, unlike the first, is complete; that is, all the feathers are replaced. Thus, it is now indistinguishable from older birds in basic plumage and no longer can be aged SY (even though it really is). We do know (based on plumage and skull) that it isn't a HY, so the best we can do is to call it "After-hatch-year" (AHY or 1).

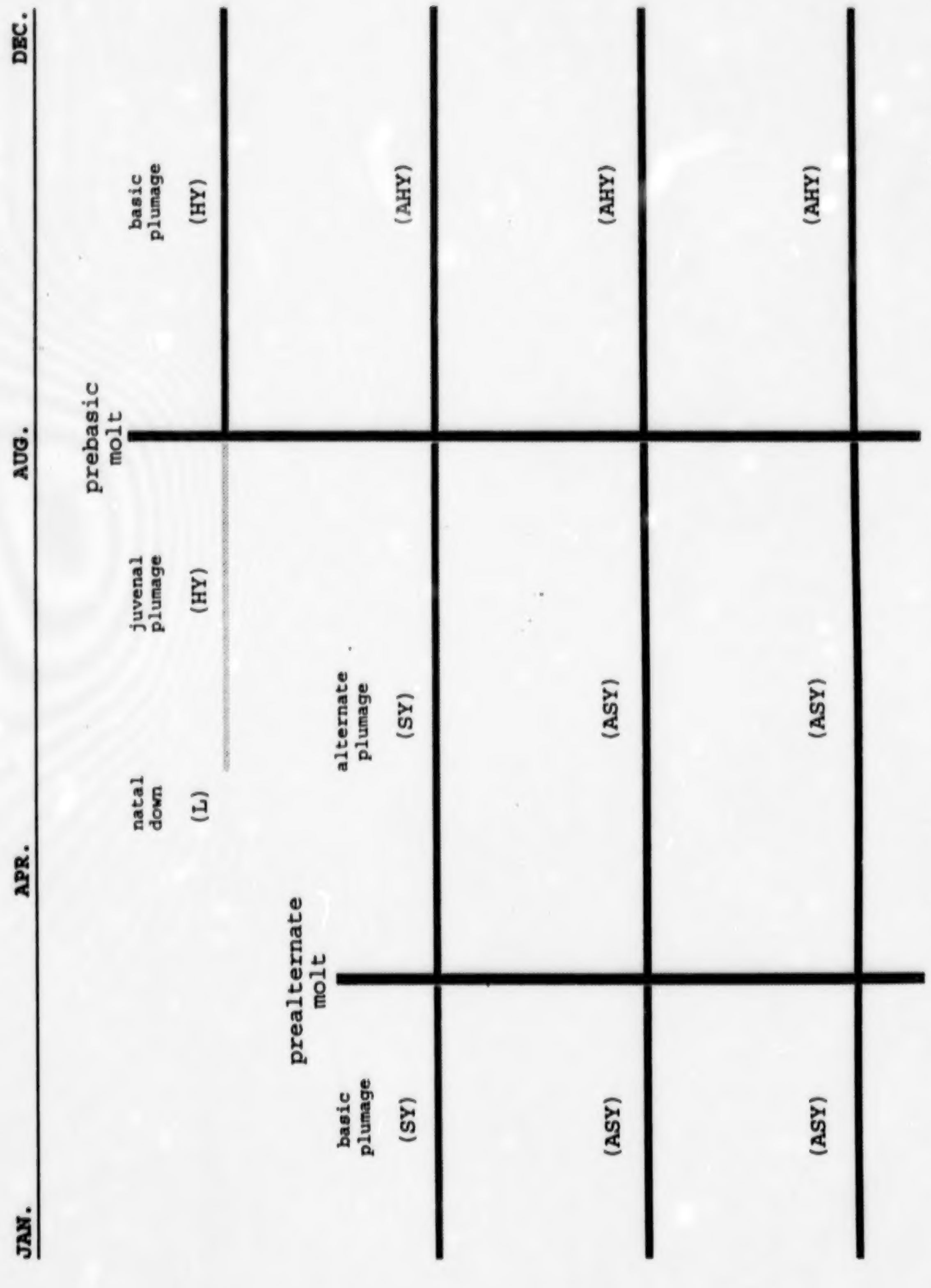
On January 1, the bird's age class changes again, even though the bird itself doesn't. Since it can be distinguished from the SY birds by the presence of adult flight feathers and primary coverts, we can call it "After-second-year" (ASY or 6). Again, it goes through a PA in the spring, attaining its second alternate plumage, which is distinct from the first. Thus, we still can call it ASY, but again only until the PB, after which it goes back to being AHY because it no longer can be distinguished from the SY birds. Except in a few groups, it is impossible to distinguish "Third-year" (TY) from "After-third-year" (ATY) birds, so this pattern repeats itself until the bird's death.

Note that we can age birds ASY only when we are able (at least in theory) to age all others of the population either HY or SY. From January 1 until the PA, the possible age classes are SY and ASY. Between the PA and PB, the possibilities are HY, SY, and

ASY, and after the PB they are HY and AHY. This applies also to species such as Least Flycatcher, Orange-crowned Warbler, and Dark-eyed Junco, which don't have distinct alternate plumages (and some of which don't even have a PA). It does not work for all species, however; some, such as Warbling Vireo and Song Sparrow, cannot be aged by plumage after the first PB. In others, such as male Common Yellowthroats, the SY/ASY distinction cannot be made after the PA (in this case, some individuals can be aged SY until the second PB, but since not all can, none can be aged ASY after the PA).

Since the basic plumages are carried over from one calendar year to the next, they are designated either HY/SY or AHY/ASY, depending on the age of the bird. The slash indicates the new calendar year. Alternate plumages, on the other hand, do not carry over and thus are designated SY or ASY only. Thus, a Yellow Warbler's plumages are JP - HY/SY - SY - AHY/ASY - ASY - AHY/ASY - ASY - etc. until death. An Orange-crowned Warbler's plumages are JP - HY/SY - AHY/ASY. A Song Sparrow's are simply JP - not JP.

It is important to bear in mind that these are generalizations and that there are many exceptions and much variability in molt strategies, timing, and duration, even within a species. Many birds cannot be aged by plumage and, in the absence of other clues such as skull pneumatization, breeding condition, feather wear, eye color, etc. must be called "Unknown" (U or 0). Some distinctions are quite subtle, and it is much better to err on the side of caution!


JAN.
APR.
AUG.
DEC.
natal down
(L)
juvenal plumage
(HY)
prebasic molt
basic plumage
(HY)
basic plumage
(SY)
prealternate molt
alternate plumage
(SY)
(AHY)
(ASY)
(ASY)
(AHY)
(ASY)
(ASY)
(AHY)